API PIPELINE REPORT p. 106

The OIL AND GAS JOURNAL
PUBLISHED WEEKLY MAY 1, 1961

Union's new

ELECTRONIC Gasoline and Mid-barrel BLENDERS

p. 86

What to expect from tax proposals ▸ 57

New twist for underwater completions ▸ 59

Marketers build for high volume ▸ 60

Electricity from gas: Big, new market? ▸ 64

Top to bottom... Brewster rig relies on Timken® bearings

This N95, 1200 H.P., rotary drilling rig which The Brewster Company recently delivered, is ruggedly designed and built to take the heavy loads imposed by today's deep hole drilling. Timken® tapered roller bearings are used in the crown block, traveling block, swivel, rotary and drawworks of this and other series rigs built by The Brewster Company. The taper lets Timken bearings take *any* combination of radial and thrust loads. Brewster Engineers say that Timken bearings provide the reliability needed for trouble-free service because of their uniformly high quality, precision design and manufacture.

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The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits. Canadian Division: Canadian Timken, St. Thomas, Ont.

Industry rolls on

TIMKEN®

tapered roller bearings

The OIL AND GAS JOURNAL
Vol. 59, No. 18

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TECHNOLOGY—OPERATION

Underground Storage Ideal for LPG 106
By G. P. Jennings

More than 50 operators of underground storage agree that more safety and lower construction costs are two big advantages. Operating problems and costs appear to be nominal.

Fewer But Abler Employes in Tomorrow's Pipelining 111
By J. A. Horner

The basic problem facing pipelining is to increase efficiency, and the main avenue open for this is better use of manpower. This means fewer employes, better trained and more highly skilled, in more demanding jobs.

Push-Button Pipelining, 5 Years Later 116
By Fred S. Jones

By the end of 1960, remote and automatic control had advanced to 37%, unattended operation to 22%. And the industry is now entering an era of accelerated evolution.

Union Oil's New Electronic Products Blender 86
By Arthur F. Stribley, Jr., M. W. Adcock, and J. F. Hannaman

The new installation for gasoline and distillate fuel has been operating without difficulty at Union Oil's Los Angeles refinery since January. It is economical and efficient.

Automatic System Fights Fire on Unmanned Offshore Platform 94
By Ed McGhee

New dry-chemical system contains all of its own power, has turnover mechanism, is simple, compact, and low in cost, and delivers large volumes.

Process Costimating—93 96

Cost of lube rerun distillation operations.

Remote-Control Crane Speeds Pipe Handling 97

Only two men are needed to move a truckload of pipe.

Dual-Weight Drill Pipe Turns in Good Performance 98
By Ed McGhee

New pipe has thin walls over most of its length, but has thick walls near box end of the joint. This gives the advantages of thin-wall pipe without its disadvantages.

Reservoir Engineering—35 100
By E. T. Guerrero

How to estimate oil in place by material balance for reservoir with initial gas cap.

Oil-Well Pumping—39 104
By Joseph Zaba

Prime movers: electric-motor drive.

Refinery Construction and operating Cost Indexes 110

Maintenance Pays Off for Dual-Fuel Engines in Pipelining 127
By Erik Kelgard

The author says: If air-fuel mixture is kept at proper value, this engine is the most economical and reliable prime mover in use today.

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 1, 1961

Oil men see very little benefits from Kennedy tax proposals:

Reaction of industry tax executives is that the President has not answered basic business problems—at best his suggestions are merely aspirins for depression pains.

Oil men expect few big projects will be started to take advantage of the tax-credit proposal. Profitability is still their guide. Needed more than the Kennedy proposals are some basic changes in national depreciation policies.

Outlook for the tax proposals aren't too good even in Washington. They face a hard fight in Congress (p. 57)*.

▼ ▼ ▼

Look down the road with L. E. Elkins, research director for Pan American who predicts:

...Future drilling will be based on pre-planning. Engineers will chart total drilling for a well before location is cleared. And they may use different methods in a single hole—air, percussion-rotary, or down-hole drilling.

...Fluid injection will account for a third of all productive capacity by 1970 and half by 1980.

...Research areas where profits can be improved include control of corrosion, control of paraffin deposition, greater use of automatic custody transfer, and expanded use of multiple completion programs.

▼ ▼ ▼

The short-lived Algerian revolt had one lesson for oil men: It proved wisdom of the French in terminating pipeline outlets for Saharan crude in two different countries.

Blockade of all Algerian commerce halted movement of 163,000 bbl. daily of Hassi Messaoud crude to the Mediterranean terminal at Bougie.

But 160,000 bbl. daily from the Edjele area kept right on moving to Gabes, located in Tunisia, which was not involved in the dispute.

Preliminary planning on a gas pipeline across the Mediterranean from Algeria to Spain is well along.

---

*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

Studies of the ocean floor by bathyscape from Gibraltar clear to Sicily indicate the best spot is a 100-mile crossing from near Oran to the southeast Spanish coast. This crossing would avoid the severe currents which prevail at Gibraltar.

Plans under discussion by French engineers now involve an 8 or 10-in. thick-wall, high-pressure line to supply a Spanish power plant. Gas would move from Saharan fields to the coast in a big-inch line and be sent to Spain at 3,000 psi.

If the line proves successful, a bundle of small-inch lines could be added to take output from the big-inch line across the sea. The gas then would be headed into a big-inch line in Spain for transmission to France.

Transwestern Pipeline has its sights set on diversifying. Plans call for one or two gasoline plants along its new line to California. It also is hunting for other gas markets besides California and is investigating projects outside the field of regulated activities.

This points up a trend among the transmission giants. Big pipeline companies are now getting hefty percentages of their revenue from non-gas operations (p. 78).

▼ ▼ ▼

The "we honor all credit cards" policy is proving expensive for independent service station operators. Losses are heavy and the job of collecting the delinquent bills nearly impossible.

The policy has allowed smaller companies to increase their sales volumes sharply but losses reportedly are mounting to the point where many independents are abandoning the policy.

Good news for gas marketers: Some gas appliances soon may be self sufficient without having to use electricity to operate motors, fans, and controls.

This is prediction of American Gas Association. It would be accomplished through reducing cost of thermoelectric devices, a project on which Transitron Electronic of Wakefield, Mass., is now working for AGA.

Start of a trend is seen in interesting agreement between Shell Chemical and Union Carbide.

Shell will market Union Carbide's polyethylene. This allows Shell to expand its plastics line without capital spending in a field already overcrowded.

Union Carbide will sell Shell's polypropylene when the Woodbury plant comes on stream in 1962. This will allow Union Carbide to test market polypropylene before deciding to invest in a plant of its own.

Possible barrier to these agreements: Antitrust attitude of Justice Department lawyers.

▼ ▼ ▼

Rotary rigs operating in the U. S. have climbed to the highest level of the year—1,691 active rigs, a gain of 53 in a week.

Previous high for the year was 1,656 on March 20.

States showing most important gains in activity included Louisiana, up 30; Oklahoma, up 14; Nebraska, up 8.

▼ ▼ ▼

Another significant discovery looms in Utah's northern Paradox basin 22 miles northwest of Big Flat at Pan American 1 Salt Wash.

The wildcat is flowing gas condensate from the Mississippian with recovery reported comparable to that of early showings for Lisbon field. Well is scheduled to drill to the Devonian.

▼ ▼ ▼

Both Phillips and OCAW gave some ground to reach settlement ending 3-month strike of 190 workers at Cactus, Tex., chemical plant.

Phillips won right to reduce Cactus force by 16 or 17 employes and to realign duties of others.

Union won wage reopener after 9 months, a separate benefits reopener, and classification pay adjustments ranging from 3 to 24 cents an hour for 133 employes. General wage raise was not an issue.

An organizing drive by American maritime unions against American-owned foreign-flag vessels—including tankers—is starting.

Unions got a green light from U. S. Supreme Court last week. It refused to review a decision giving the NLRB jurisdiction in a labor dispute involving a Liberian-flag ore carrier shuttling between Venezuela and Philadelphia.

This and two other cases provide the American unions with an invitation to push for NLRB-sponsored elections to wrest bargaining rights from foreign unions.

Refinery wage study made by OCAW union shows: Average pay of stillman is $3.431 hourly and of top craftsman is $3.212. Highest for operator is $3.569 on East Coast and lowest $3.301 in southern California. Average refinery wage is up 93.5 cents in 8 years.

▼ ▼ ▼

The Washington beat:

House-Senate conferees on minimum-wage bill are leaning heavily to liberal version backed by Kennedy and passed by Senate. Oil marketers are watching closely, hopeful they will still be excluded from overtime provisions.

OCDM is getting rash of requests now for a hearing to determine if residual-fuel-oil import controls are necessary to the national security. A decision is imminent.

Standing Senate committee probably will make a fuels study. That's outlook now. If so, it will be setback for coal interests which had pressed hard for a specially chosen panel.

Rear Adm. O. P. Lattu, director of Military Petroleum Supply Agency, will be transferred in August to inspector general's office. New director will be Rear Adm. Thomas Becknell, now on duty in Honolulu. Also Rear Adm. John Crumpacker is replacing Rear Adm. J. W. Boundy as chief of bureau of supplies and accounts, which has jurisdiction over MPSA.

Market Memo

May 1, 1961

Gloomy outlook for gasoline is beginning to brighten.

With the motoring season only a few weeks away now, actions of refiners in trying to keep the supply-demand balance are showing better results.

Refinery runs eased off another 24,000 bbl. daily last week to average 7,765,000 bbl. daily. That's also off 202,000 bbl. daily from same week last year.

Four product stocks, meanwhile, dropped 3,531,000 bbl., but more important gasoline stocks dropped 951,000 bbl. to total 222,225,000 bbl. Gasoline stocks have dropped 4 weeks straight and now are off 4,443,000 from last month's off-season peak.

Spot gasoline prices are ragged in isolated areas but suppliers generally are managing to hold their postings. Feeling is that areas of oversupply may be dried up before they spread. Esso raised its dealer prices in the Carolinas. Mobil did the same in Wisconsin.

Heating oils have reached the end of the season, and it's time for the usual May price reduction. Heavy fuel prices vary all over the lot.

Continental has met the price increases of Gulf for Permian basin sour crude. It posted a 6-cent raise for Southeast New Mexico sour, putting the top at $3.01 for 40°-gravity with a 2-cent instead of a 3-cent differential downward. Continental buys 14,000 bbl. daily in the area.

Gulf, Texas Standard, and Continental are now paying the premium in New Mexico with Gulf and Standard posting similar prices for West Texas sour.

Over in East Texas, other buyers so far haven't adjusted their postings following Tidewater's 15-cent cut to $3.10 last week. Four price levels have prevailed for months in East Texas.

Canadian crude will crack the Buffalo refining market for first time in May. Ashland will start taking 8,000 bbl. daily for its 29,000-bbl. refinery.

Another prospective customer is Mobil's 29,500-bbl. refinery. Volume of Alberta crude moving into this market is expected to hit 25,000 bbl. daily within the next year.

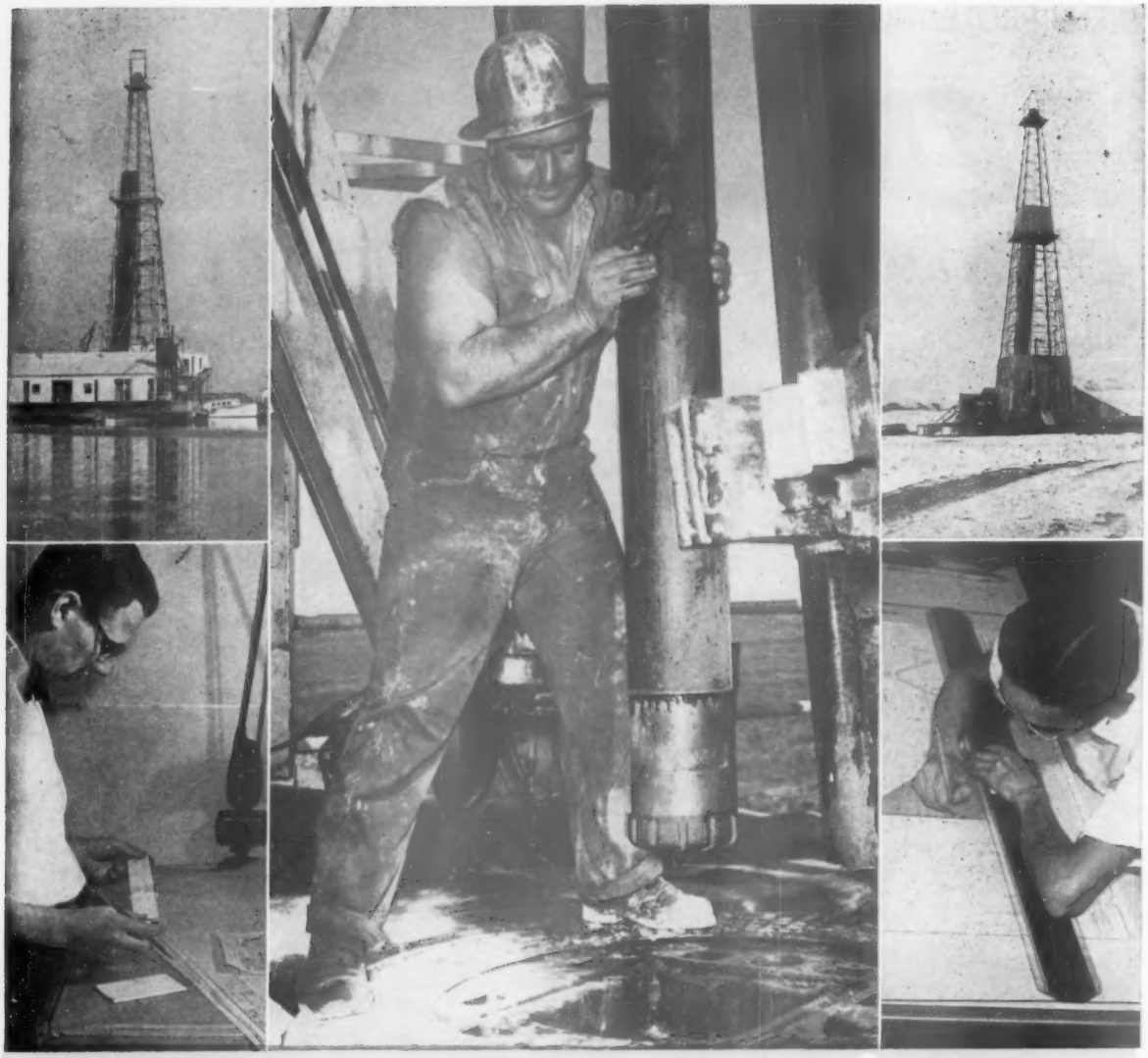
Canadian sources, meanwhile, report Canada's production will reach all-time high of 645,000 bbl. daily during May, up 37,000 bbl. from April.

Exports to U. S. for first 5 months will be up 30,000 bbl. daily over last year while sales to domestic refiners are up only 15,000 bbl. daily. Export market thus is growing twice as fast as domestic.

WELL PROTECTION AT ITS BEST STARTS WITH

LONE STAR OIL WELL CEMENTS

Trade names property of Lone Star Cement Corporation, New York 17, N. Y.



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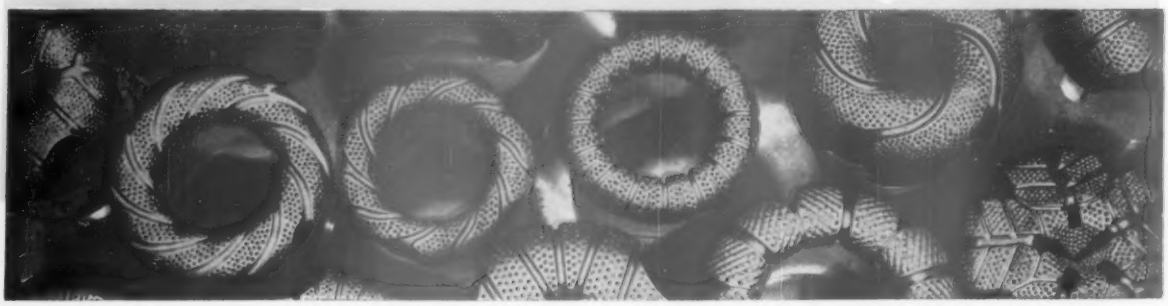

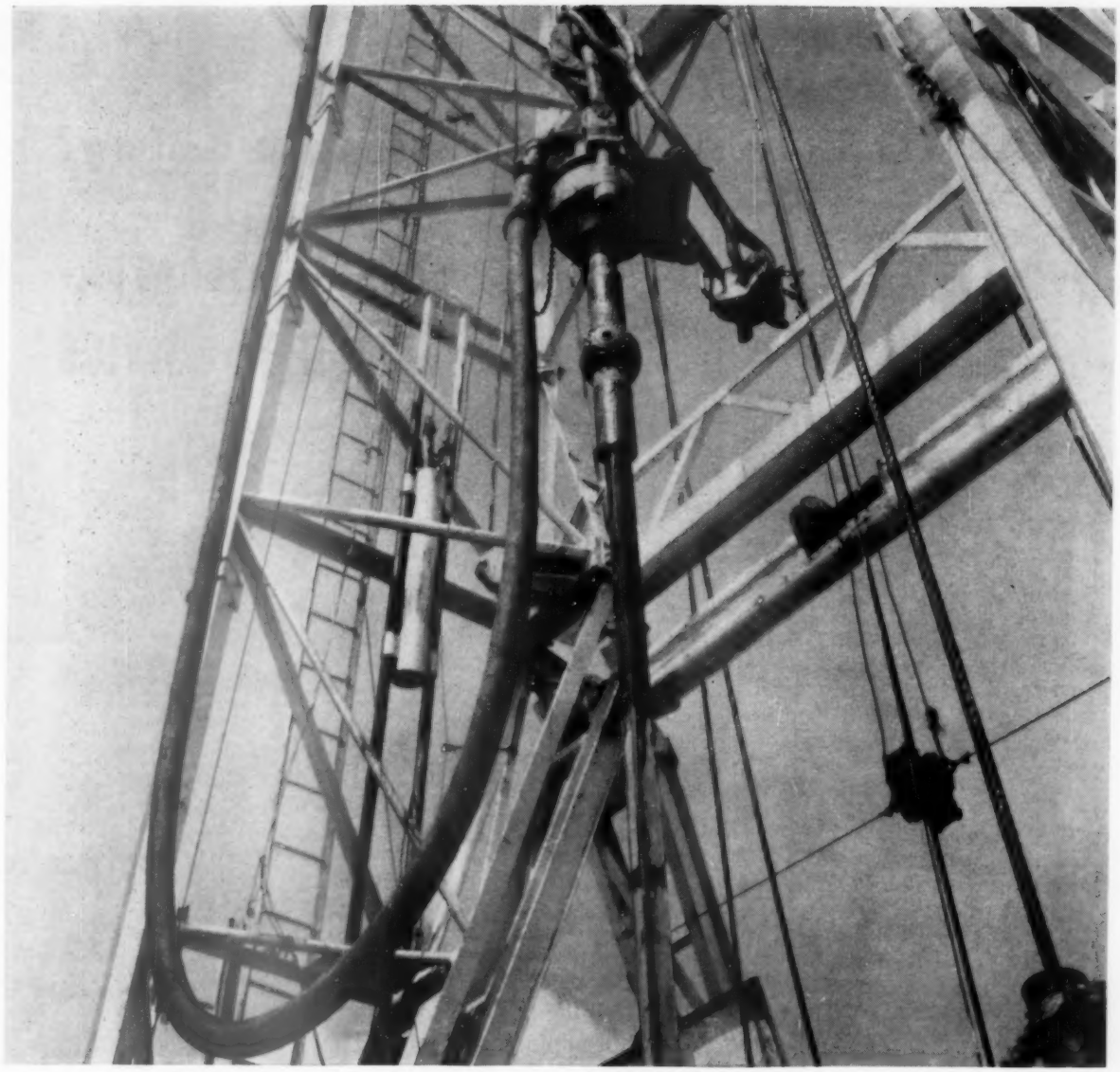

No blow, no crack, no rot with B.F.Goodrich rotary drilling hose

THIS is the hose that's been built to take rough on-the-job treatment. It's B.F.Goodrich Highflex hose and it's proved itself again and again by outlasting other types of hose by several years. Its thick, tough cover resists banging, gouges, scrapes and tears. Weather doesn't weaken it. Oily mud won't make the tube rot or swell.

Highflex hose is built with extra strength to take extreme bottom hole pressures. Spiral-wrapped cable wires used as reinforcement resist burst, qualify it for Grade C (5000 lbs. test pressure) A.P.I. Additional plies of wire and fabric at hose ends protect against bending stress and prevent blowouts at couplings.

Despite its strength, Highflex hose is the most flexible made for heavy duty service. It's easy to attach to the rig, hangs well from the standpipe and coils easily without kinking.

B.F.Goodrich Highflex hose is in stock at leading supply stores in the oil field, or at any of these B.F.Goodrich warehouses: Los Angeles, Great Bend, New Orleans, Shreveport, Hobbs, Oklahoma City, Tulsa, Corpus Christi, Dallas, Houston, Kilgore, Odessa, Wichita Falls. *B.F.Goodrich Industrial Products Company, M-998, Akron 18, O.*

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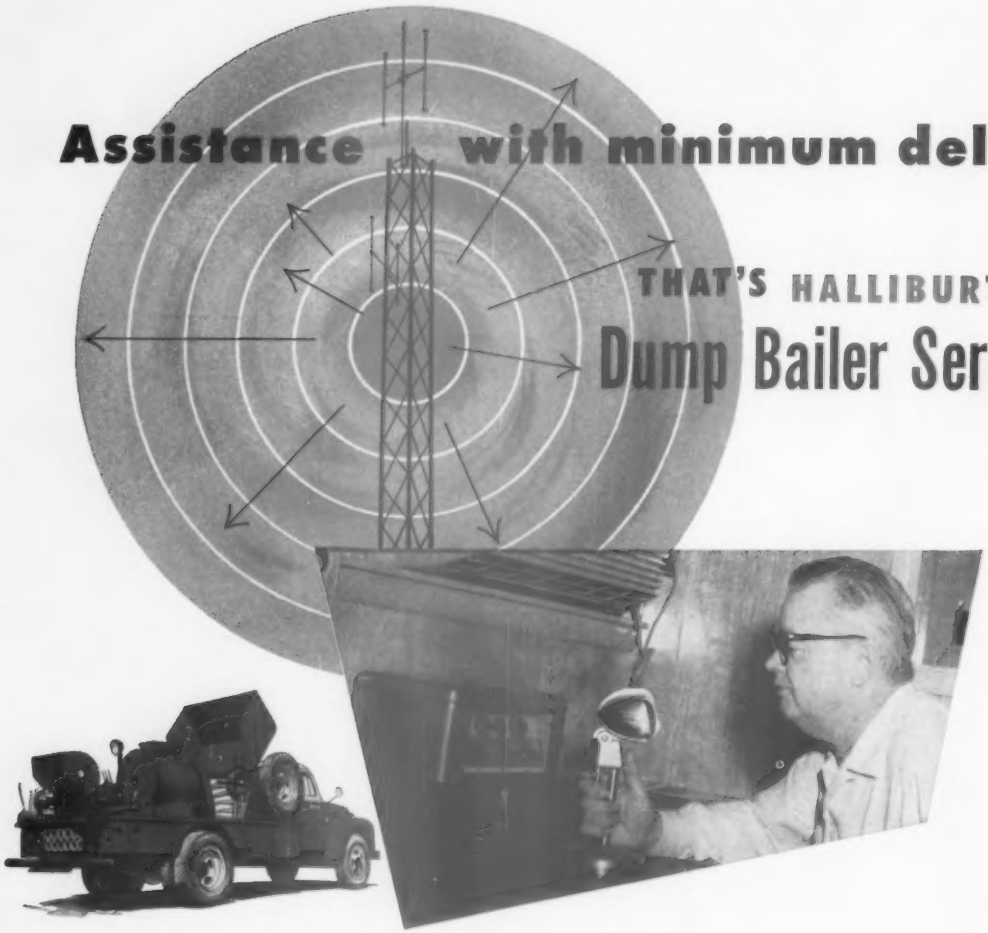
OIL FIELD PRODUCTS

Assistance with minimum delay!

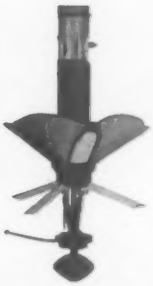
THAT'S HALLIBURTON
Dump Bailer Service



When remedial cementing means the loss of costly rig time, or threatens the loss of production itself, you need assistance with a minimum of delay. That's why it pays to call Halliburton Dump Bailer Service. Halliburton is as near as your telephone; all Dump Bailer Service fleet units are radio-equipped for extra-speedy service... available 24 hours a day.

The continuous Halliburton program of Dump Bailer Service development makes available a wide range of materials and equipment tailored for most job requirements. On jobs requiring—bridges, plugs, water shut-off, aluminum alloy removal, shot tamps—you are assured of prompt assistance... and service that is based on more than 20 years of Dump Bailer experience.

In every phase of remedial cementing operations... tools, equipment, materials, experience, *and* prompt dependable service... Halliburton leads the industry. Call your nearest Halliburton field office for the best and most dependable Dump Bailer Service.

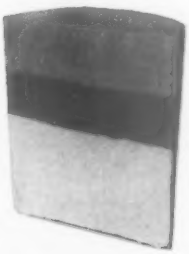


"DB" BRIDGING BASKET

An efficient umbrella type that bridges open holes or casing from 4" to 15" I. D. . . . field-proven in hundreds of dump bailer jobs, the drillable basket has demonstrated its efficiency in wells exceeding 13,000 ft. The "DB" Bridging Basket forms a dumping bridge for additional materials and saves time in isolating formations, locating and repairing casing leaks, squeezing, acidizing and other operations.

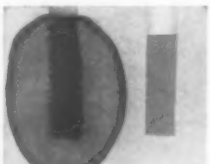
CAL-SEAL

A quick-setting, super-strength gypsum cement especially effective for dump bailer jobs such as bridge plugs, split pipe, blowouts and shot tamps . . . Available in three types for controlled setting to meet special conditions, Cal-Seal's 0.3% lineal expansion during setting tightens plug in hole or fissure. Its rapid strength development and low permeability provide a cementing material that is easy to apply, readily drillable and economical to use.



HYDROMITE

A proven waterproof plastic cement, composed of a special gypsum cement and a powdered resin, particularly adapted for dump bailer equipment . . . The setting time of Hydromite can be controlled to very close limits, with the initial set occurring within 75-100 minutes. It will set in temperatures ranging from 60°F to 225°F. . . Unlike a portland cement slurry, the resin in the fluid phase provides an impermeable seal when squeezed into the formation. This feature, together with Hydromite's 0.3% linear expansion during initial set, makes it a tight non-permeable plug for shutting off bottom hole water in producing wells.



RESIN-CEMENT

A blend of resins, water and Portland Type Cement formulated for individual well requirements. Resin-Cement is effective for open hole bottom plugs and may be placed by dump bailer or by pumping. Has application in most oil, gas or water bearing formations, including sandstone or limestone, with temperatures from 80°F to 230°F. . . Set Resin-Cement is permanent in nature and not normally affected by oil, mud, or corrosive waters or gases.

HYDRO-LOK (PC-11)

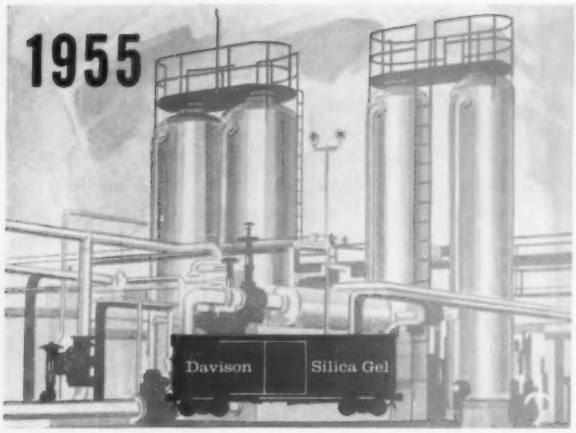
Hydro-Lok (PC-11), consisting of a thermosetting resin and inert solids used as bulking agents and for fluid loss control, is especially effective for water shutoff. This material is placed like cement slurry and may be dumped with bailer, if desired. PC-11 sets in one to three hours after being placed in the hole; the resin phase which is squeezed into the water formation sets in less than an hour because of the accelerating action of water.

HALLIBURTON

DUMP BAILER SERVICE

HALLIBURTON COMPANY • DUNCAN, OKLAHOMA

"CONTINUE TO LOOK TO HALLIBURTON—FOR LEADERSHIP"



Because it can actually repay its cost . . .

Davison Silica Gel for natural gas drying has more than tripled in use in only 6 years!

Last year over three times as much Davison Silica Gel was installed in natural gas drying operations as was sold in 1955! 320% increase . . . in only 6 years. The growth hasn't stopped yet. More and more natural gas processors are switching to Davison Silica Gel.

Why? Davison Silica Gel can actually repay your cost of natural gas drying with recovery of valuable hydrocarbons. The large surface area and pore volume of Silica Gel attain recovery efficiencies up to 95%, producing as much as 3 gallons of usable pentane-plus per 100 pounds of Davison Silica Gel.

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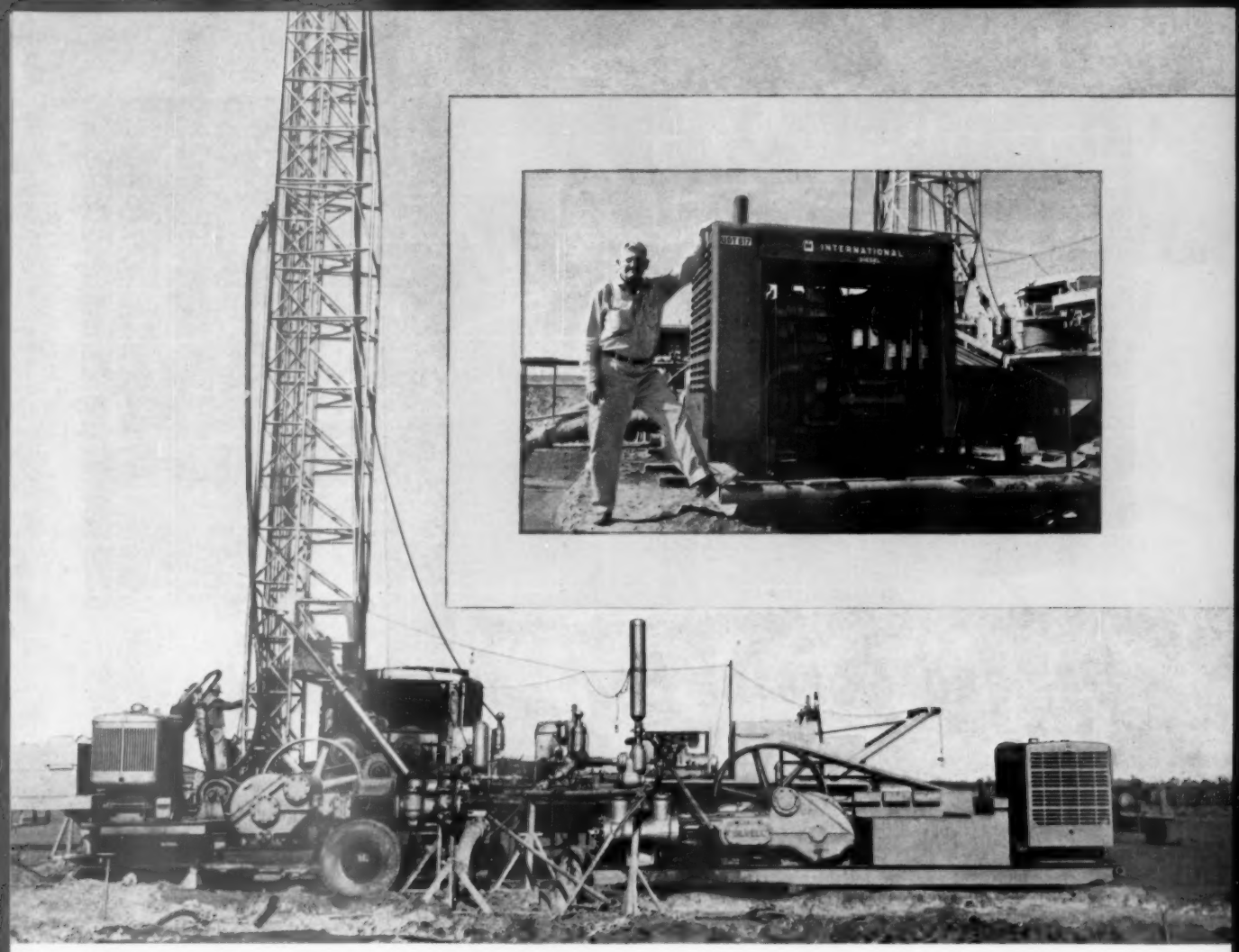

35-year experience shows International *best oil field power!*

"I have worked the oil fields 35 years, and haven't found anything harder on men and equipment than just plain drilling. I like International engines for their toughness and ability to take rough use day after day and keep going. They can really take it!" —Andrew Dickens, Partner, Valley Oil Co.

Ask an old pro if you want the lowdown on power efficiency in the oil fields. Andrew Dickens, Valley Oil Co., Cottula, Texas, has been in the business for 35 years, and he knows a lot about engines. Mr. Dickens backs up his preference for International with facts. The Valley spread shown above is powered by four IH engines—a new UDT-817 and a UD-525 on mud pumps, plus two older and still efficient IH diesels on drill and draw works.

Experience is important to an engine builder, too. It's no coincidence that International, the world's oldest and largest producer of heavy-duty engines, also produces the most efficient power for heavy-duty applications. Thousands of customer records, kept over the years, show that International engines work harder and last longer on the tough jobs!

Your power requirements can be quickly and easily handled with a call to your nearby International Engine Dealer or Distributor. He has complete information on the 35 models—16.8 to 385 max. hp.—in the International line. Call him today!

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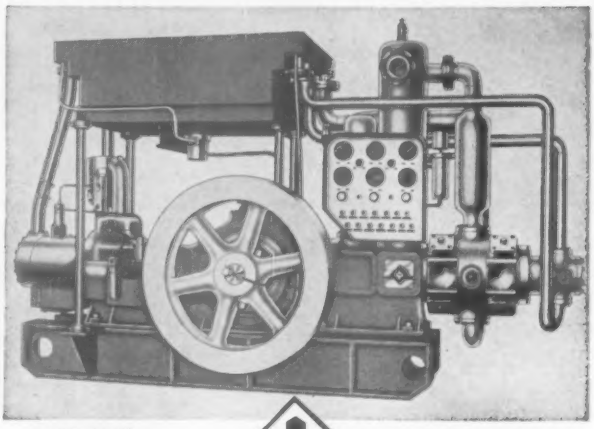

THE *NEW* DPC-60 ENGINE-COMPRESSOR UNIT

AJAX

AJAX COMPRESSORS

AJAX . . . also builders of ENGINES . . . PUMPS

AJAX IRON WORKS CORRY, PENNSYLVANIA
Oil Field Distributors

- The National Supply Co. — Pittsburgh, Pennsylvania
- Bethlehem Steel Co. — Supply Division, Tulsa, Oklahoma
- Mid-Continent Supply Co. — Fort Worth, Texas

YOU CAN SAVE TIME AND MONEY ON RIGGING JOBS!

HERE two Northwest 35-ton Truck Cranes swing a 78,000 lb. draw works into place on a rigging job. The two cranes completed the entire rigging operation in 6½ hours after the release of the derrick.

Northwest Truck Cranes bring ease and reduce cost to operations like this. The smooth accuracy with which these machines can team up and hit the bolt holes . . . the advantages that come with having the true "feel" of the load . . . the combination of the velvet action of the Swing Clutches and Northwest Independent High-Speed Boom Hoist . . . give you a unit that wastes no time in getting assemblies into place—whether in the field or at the refinery.

Note the Dragline Fairlead in place on the right hand machine. With the Northwest Third Drum you have an extra load line and can switch from dragline to handling pile driver leads without time loss or delay. Many other Northwest features make the Northwest, whether on rubber or on crawlers, a better machine for oil field service. Let a Northwest man give you the full story.

NORTHWEST

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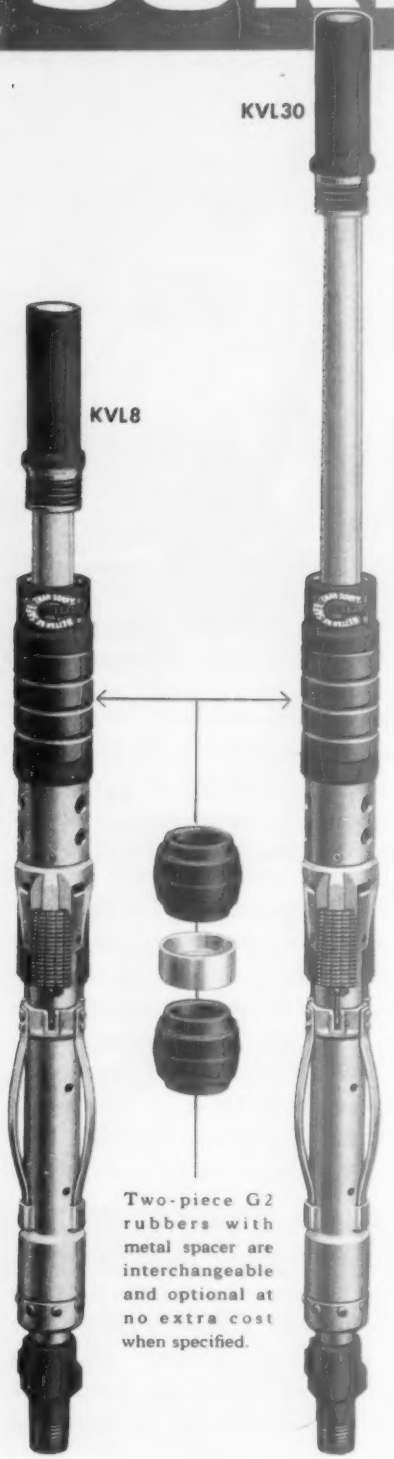
SAFE and SURE

GUIBERSON'S KVL PACKERS



Two-piece G2 rubbers with metal spacer are interchangeable and optional at no extra cost when specified.

With Automatic Latch

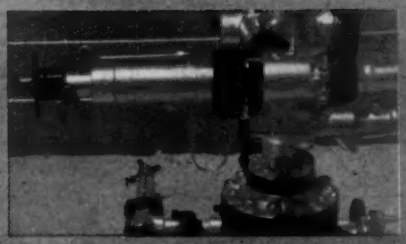
Operators who want extra assurance that a packer won't come unlatched going in, depend on Guiberson KVL packers. Rugged and durable, KVL packers have earned a reputation for dependable performance in deep and medium depth wells. These retrievable packers are easy to set and release, with ample bypass and positive seal. When running into a liner the KVL stays latched and drag springs provide an excellent guide — features operators like. For conserving gas energy and increasing production in flowing wells; for completing wells by circulation; for acidizing, repressuring and dozens of other uses, the KVL is unsurpassed.

- Made as the KVL30 with 30″ valve stroke or KVL8 with 8″ valve stroke for standard below-packer circulation. (Both packers also made with perforated mandrel for circulation above packer.) Available in casing sizes 5″ through 9⅝″.
- Valve has two independent sealing elements, a tapered metal valve and seat and a set of oil-resistant seal rings, affording double-sealed protection.
- Rubbers made of special oil and gas resistant compound. Will not vulcanize to casing — recover original shape when released.

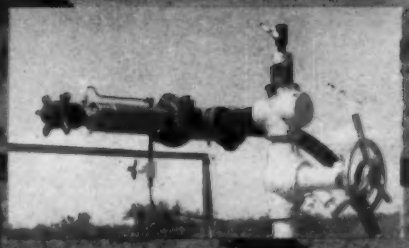
THE GUIBERSON CORPORATION

ESTABLISHED 1919

DALLAS, TEXAS U. S. A.



Reagan County, Texas
(Dual Completion).



Crawar Field,
Ward County, Texas.

Monument Field,
New Mexico.

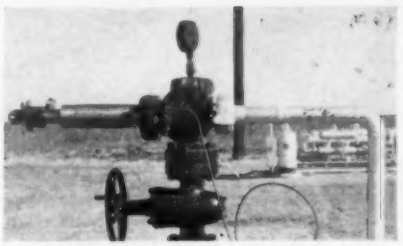
"PRESSUREMATIC"

it's both a wing valve and a high/low safety valve

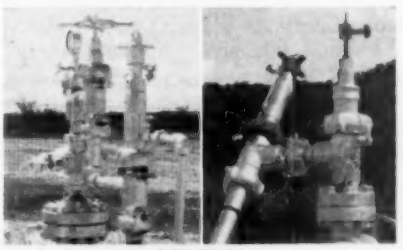
Here is a valve that does the work of two valves yet costs little, if any, more than a good high pressure valve alone. It operates manually for choke changing, or automatically as a high-low safety valve.

The **UNIBOLT PRESSUREMATIC VALVE** combines all of the time-tested and proven features of the Unibolt Adjustable Wing Valve with a novel automatic actuating accessory. The valve closes instantly when a pre-determined pressure balance across the seat is disturbed. The actuating mechanism consists of a small piston which is exposed to well pressure and a larger piston which is exposed to flowline pressure. A broken flowline or open valve, for example, in the production system, would lower the flowline pressure and thus instantly close the valve. Once closed, the valve may be easily opened and set manually for automatic operation. The downstream or low pressure line may be tapped at any remote point and thus embrace any desired portion of a gathering and treating system. Offshore and other remotely controlled wells could be shut in automatically in case of fire, ship collision, etc. The unique design lends itself to many such applications.

Send for literature or contact your nearest UNIBOLT sales representative.



Monument Field,
New Mexico.



Left—Lancaster Hill Field
(Ozona area, West Texas);

Right—Reeves County, Texas
(Dual Completion).

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas

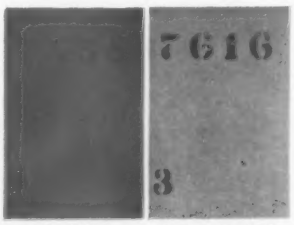
Durable tank paints that keep uniform color

That's what you get when you specify paints made with M50® Basic Lead Silico Chromate pigment.

Paints made with *M50*® Basic Lead Silico Chromate pigment not only protect metal, but have remarkable resistance to chalking and fading in harsh industrial atmospheres that threaten color uniformity. They provide "Defense-in-Depth" against corrosion.

And Basic Lead Silico Chromate can be tinted in an unusually wide range of colors—bright hues, soft pastels and other combinations—that can convert your tanks and installations into attractive outdoor "advertisements" for you.

Next time you buy paint for decorative metal protection, specify paints made with *M50* Basic Lead Silico Chromate—the pigment that offers primer-protection in every coat, plus durability, uniform resistance to weathering and wide color range.



Typical M50 pigment paint | Typical standard specification paint

Test panels after being exposed for 18 months in an industrial atmosphere.

M50 an oncor® *Pigment... A Development of* National Lead Company

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SALES ARE OFF
on slush pump parts
AND WE LIKE IT!

Considering the great number of Continental-Emsco slush pumps running, orders for replacement parts are surprisingly few. This we like. Our customers like it even better. It means they are able to keep drilling contracts *on schedule* with less costly downtime.

Routine maintenance on C-E pumps is fast and simple, with automatic lubrication . . easy-to-open valve pot covers for quick valve inspection or replacement . . "exposed" liner design to help prevent washouts and "sanding-up." These and many other Continental-Emsco pump features have been proven under the world's toughest drilling conditions for nearly 25 years.

You can cut your parts bill and downtime, too. Call a C-E man and talk slush pumps.

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SP 104

CONTINENTAL-EMSCO COMPANY, a Division of The Youngstown Sheet and Tube Company, General Offices: Dallas, Texas; Export Division: 30 Rockefeller Plaza, New York, N. Y. • Continental-Emsco Company Limited, General Offices: Calgary, Alberta, Canada Continental-Emsco Company C. A., Caracas, Venezuela • Plants: Houston and Garland, Texas; St. Albans, Herts, England • *Representatives in All Principal Oil Fields of the World*

SAFE, SIMPLE, SILENT GROVE FLEXFLOS®

FOR ANY PRESSURE REGULATING NEED

There's a complete line of Grove Flexflo regulators for pressure reducing and back pressure services. Flexflos can be supplied self-operated, pilot-operated or with Grove electric, pneumatic and hydraulic operators. A single moving part—a silently flexing rubber tube that can never slam, stick or wedge, makes Flexflos simple, dependable. The tube assures positive shut-off even though foreign matter may be trapped between the core and tube. In cast iron or steel; screwed end: 1" to 3", flanged end: 2" to 12". Control pressure ranges from 2 psi to 1500 psi.

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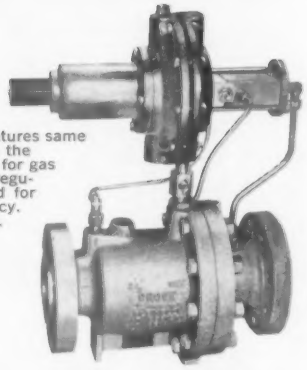
GAS BACK PRESSURE FLEXFLOS

Model 888, self-operated, gas dome-loaded. Setting is fast, easy, without springs or pilots. Recommended for natural gas, air and liquids. Bulletin #888-D.

GAS PRESSURE REDUCING FLEXFLOS

Model 80-820 where extreme accuracy is critical. Sensitive, spring loaded model 820 Grove pilot is a diaphragm controlled, three-way throttling valve. Seven adjustable spring ranges from 2 psi to 1200 psi. Send for Bulletin #813-B.



Model 80-830 features same type of pilot as the 80-820, adapted for gas back pressure regulation. Designed for extreme accuracy. Bulletin #813-B.

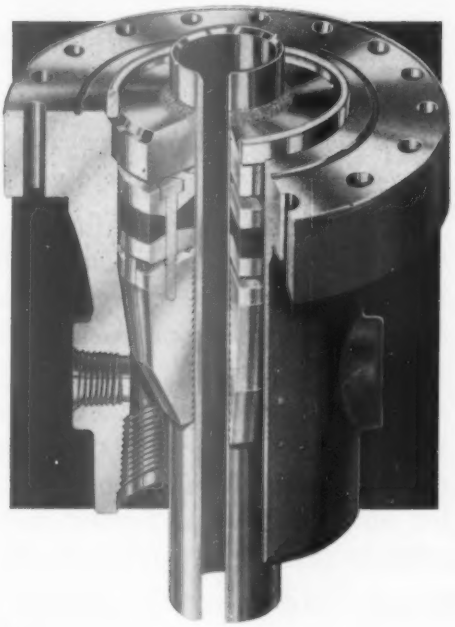
Grove Sets Regulator Standards for Others to follow

Model 80-896A, designed for "pounds to ounces" pressure reduction. For inlet pressures to 100 psi and adjustable control ranges from 2 ounces to 20 psi. Bulletin 813-B.

Model 80-833, for low pressure services. 833 pilot is available with three adjustable spring ranges: 10-30 psi, 15-75 psi and 25-150 psi. Bulletin #813-B.

Rector M-4

A low-cost casing head designed for positive trouble-free completions



The Rector Type M-4 casing head is a simple and compact head, designed especially for the safe, economical completion of any medium pressure range well.

The Rector M-4 seals permanently, without the use of resilient packing. It carries a restricted ring groove for final setting which upgrades the working pressure of the flange connection to the next higher rating, permitting connection of the next higher pressure rated tubing head without the use of cross-over flanges.

The Rector M-4 flange has a standard A.P.I. ring groove for attachment of drilling control equipment and is furnished with a removable drilling protector ring.

For economy and dependability choose a RECTOR M-4 casing head for your next completion. Available through your favorite supply store or your RECTOR representative.

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Rector

WELL EQUIPMENT CO., INC.

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EXPORT REPRESENTATIVES: CONTINENTAL-EMSCO CO., MID-CONTINENT SUPPLY CO., OILWELL DIVISION OF UNITED STATES STEEL CORPORATION

Du Pont announces a new kind of line pipe specifically developed for oil-field use

Performance proven in extensive field tests

Du Pont **DELRIN** ACETAL RESIN PIPE is a completely new type of pipe developed by Du Pont research to meet the rigid requirements of oil-field applications, such as flow lines, gathering lines, water flood lines and salt-water disposal lines. The ability of **DELRIN** PIPE to do these jobs stems directly from the unique properties of **DELRIN** —a new engineering material designed by Du Pont to give performance and cost advantages once reserved for metals.

Here's why **DELRIN** PIPE is uniquely suited for the oil-field applications listed above—and why it can afford you substantial savings in installed-pipe costs:

- It is strong and tough . . . with ample reserves of strength to provide long-term service under the conditions actually encountered in the field. It is even stronger under pressure-surging conditions than under steady peak pressure. It remains strong and tough at temperatures from sub-freezing up to 160°F. and beyond, and in the presence of crude oil.

DELRIN™ PIPE

ACETAL RESIN

DU PONT

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Manufactured, sold, serviced and backed by Du Pont

BETTER THINGS FOR BETTER LIVING...THROUGH CHEMISTRY

- It is corrosion-resistant, both internally and externally . . . functions equally well buried or laid on top of the ground.
- Because of an extremely smooth internal surface, **DELRIN** PIPE has very low friction loss, and resists paraffin build-up with all paraffin-based crude so far encountered.*
- It is easily joined by heat fusion to a leak-free integral joint ready to operate at full line pressure within minutes.
- It provides low shipping costs, easier handling and lower installation costs.

These are the facts. They have been established by more than five years of intensive laboratory testing by Du Pont, and by over two years of field testing in various oil-producing areas of the country, conducted by major oil companies.

Du Pont invites you to examine the **DELRIN** PIPE verifying data in detail. You may obtain complete engineering specifications, plus detailed analysis of various field installations by mailing the coupon below. Your request will also bring full information on prices and availability and the location of Du Pont technical representatives serving the oil industry.

**See detailed reports on tests installations, available by mailing coupon below.*

One of many field tests, establishing the performance of **DELRIN** PIPE. This 1,050-ft. flow line was buried at Madison, Kansas. A plunger pump gave 55 surges per minute (0-170 psi maximum) at the 20 s.p.m pumping rate, 24 hours a day. Recording gauges showed no change in operating pressure during a total of 1½ years of service. No sign of paraffin build-up, in contrast to serious build-ups experienced with previous lines.

Fast, integral joining is accomplished within 25 seconds or less by a simple heat fusion process. **DELRIN** PIPE may also be easily joined with metal pipe. For complete installation details, mail coupon below.

Polychemicals Department, E. I. du Pont de Nemours & Co. (Inc.)

Mail this coupon for information that can help you save money on your next pipe installation . . .

Du Pont Company
Dept. OG-5, Room 2507P, Nemours Building
Wilmington 98, Delaware

Please send me complete information on **DELRIN** PIPE for oil-field installations.

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How C-B/S Compressor Designs Solve Your Problems in Gas Gathering

Whether your problem revolves around fine compressor balance for barge-mounted operations, remote control or split gas streams, C-B/Southern people understand your needs. Their application experience is coupled with actual oil and gas producing background. That is why they can provide you with on-the-spot suggestions to economically solve your toughest gas gathering problem. This background is enhanced by company knowledge gained in building more than 40,000 compressor horsepower last year.

C-B/Southern's experience extends through Design, Engineering and Manufacturing Departments. It reaches all the way to future service from 22 Cooper-Bessemer service offices.

A point worth remembering: C-B/S packaged compressor plants are available in horsepower ratings from 100 to 1440; unitized compressors, both reciprocating and centrifugal, to 10,500 horsepower.

CB/S

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CB/S

C-B/Southern, P. O. Box 19267, Houston 24, Texas • HOmestead 8-5441

A division of The Cooper-Bessemer Corporation

MANUFACTURERS OF PACKAGED COMPRESSOR PLANTS FOR GAS GATHERING, GAS LIFT, GAS INJECTION APPLICATIONS

New Visco Well-Treating Formula Penetrates, Loosens, Disperses Deposits in Tanks, Lines, Tubing

Lowered pumping pressure, Tripled production, Dispersed solid paraffin... Among Spectacular Performance Results with Visco 1111

Visco 1111, on the job in oil and gas producing wells, water-injection wells and salt water disposal systems, has amazed even the most optimistic with its performance and economy. Here are a few examples of how it works to penetrate, loosen and disperse deposits of paraffinic-asphaltic compounds, carbonate scale, sodium salt deposits, iron compounds and other materials causing loss of production.

Cuts Pumping Pressure 175 psi

Injection pressure was 325 psi on a water injection well. Foreman believed pressure was due to a tight formation, but agreed to a test of Visco 1111. Pressure is down to 150 psi—and staying there, with one-gallon-per-day dosage of Visco 1111.

7-Well Cleanup Nets 60 bbl. Increase

Sticking pumps, caused by scale build-up, were causing frequent rod-pulling jobs on a 7-well East Texas lease. Visco 1111 cleaned up the pumps and tubing, upped production 60 bbl. per week. Company now using Visco 1111 on all their wells in East Texas.

Stopped Reperforating Need

On another East Texas lease, wells making high salt water with low-gravity oil tended to scale up and require periodic reperforation. Visco 1111 was given a trial on a well making only 3 bbl. oil and 20 bbl. water a day... quickly jumped daily production to 23 bbl. oil and 60 bbl. water. Cost: only $23.50 . . . as against $300 to reperforate.

Solid Foot of Paraffin Gone

A 500 bbl. tank contained 470 bbl. oil and a 12-inch paraffin bottom—so hard that an oil thief would not drop through. 5 gallons of Visco 1111 and 48 hours later the tank went on at 0.5% B.S. & W., *and no bottom at all.*

Easy to Use, Too!

Visco 1111 has excellent blending characteristics under a variety of field conditions, and does not gel when added to water. Your Visco Service Man will be glad to help you determine proper Visco 1111 dosages for best performance and economy on your leases. Ask him about this new well-treating product . . . or write us, today, for detailed product data.

VISCO PRODUCTS COMPANY
Incorporated
A Unit of Nalco Chemical Company
1020 Holcombe Boulevard **Houston 25, Texas**

Visco®
. . . Serving the Oil Industry through Practical Applied Science

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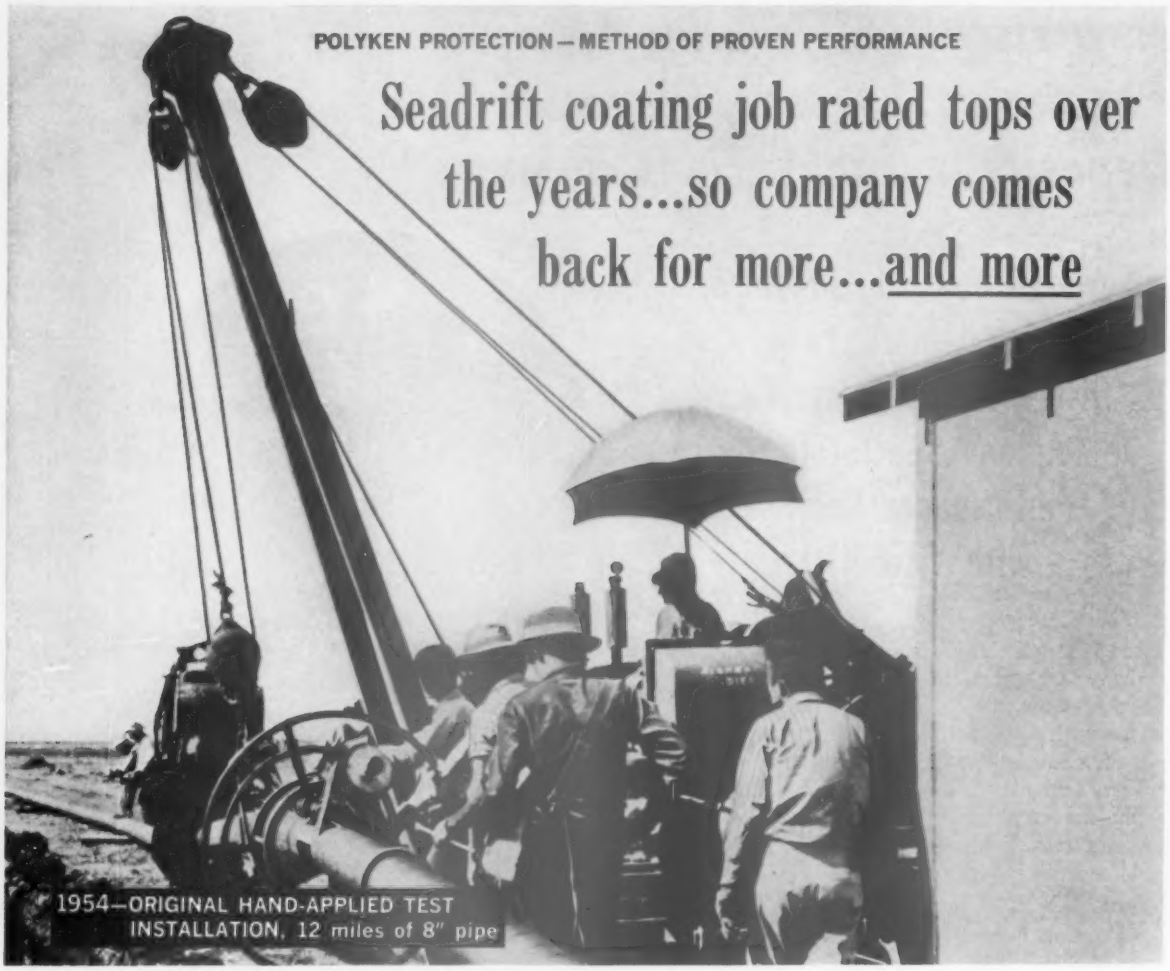
POLYKEN PROTECTION—METHOD OF PROVEN PERFORMANCE

Seadrift coating job rated tops over the years...so company comes back for more...and more



1954—ORIGINAL HAND-APPLIED TEST INSTALLATION, 12 miles of 8" pipe

1957—ANOTHER SEADRIFT INSTALLATION, 31 miles of 6" pipe
1960—STILL ANOTHER SEADRIFT INSTALLATION, more than 300 miles of 6" and 8" pipe
1960—ANOTHER MAJOR PRODUCTS PIPELINE INSTALLATION, on 8" pipe

Bell hole examination convinces second firm, too, to make important use of Polyken protection!

Proof of dependable performance . . . most graphic endorsement of Polyken. In 1954, Seadrift Pipeline Co. test-installed gas pipeline from Bee County to Seadrift, Texas, wrapped with Polyken #900 Black. Very satisfactory cathodic protection requirements on the line made Polyken tape the choice again on a job from Live Oak County to Seadrift in 1957.

In 1960, a bell hole examination of the original job showed Polyken tape still in top-rated condition after 6 years. No pipe rust or corrosion. No time-wear or deterioration of tape. So, fully convinced Seadrift officials put Polyken protection to work on their 1960 projects. And engineers from *another* major pipeline company, equally impressed, ordered this *proven performance* coating for an important part of their new products line in Iowa.

This kind of performance adds to the growing list of Polyken tape users some of America's most exacting firms. Get full details on Polyken performance and economy from your Polyken representative, or write Polyken Sales Division, 309 West Jackson Blvd., Chicago 6, Ill.

Polyken®

EXPERIENCED IN PROTECTIVE COATINGS

THE KENDALL COMPANY
Polyken Sales Division

THE *BIG* NAME IN PIPELINE PUMPS

What is the most important part of a pipe line pump?

The name on the pump, and what it stands for.

Discuss pumps with any group of pipe line engineers and they will tell you no name is seen more often in the field, or commands more respect, than GASO.

Why? Because these men know from experience that the GASO name stands for engineering, performance, life and operating economy so outstanding that the specification of Gaso Pumps has been adopted as a corporate policy by many of the world's best known, best managed pipe line companies.

Add to the assurance of top performance the convenience of fast cooperative service from close-by distributors, and you begin to understand why GASO is the big name in pipe line pumps.

GASO PUMPS
for every oil industry need

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POWELL PETROLEUM **VALVES**

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ON THE LINE
OR IN THE HOLE

STANDS FOR
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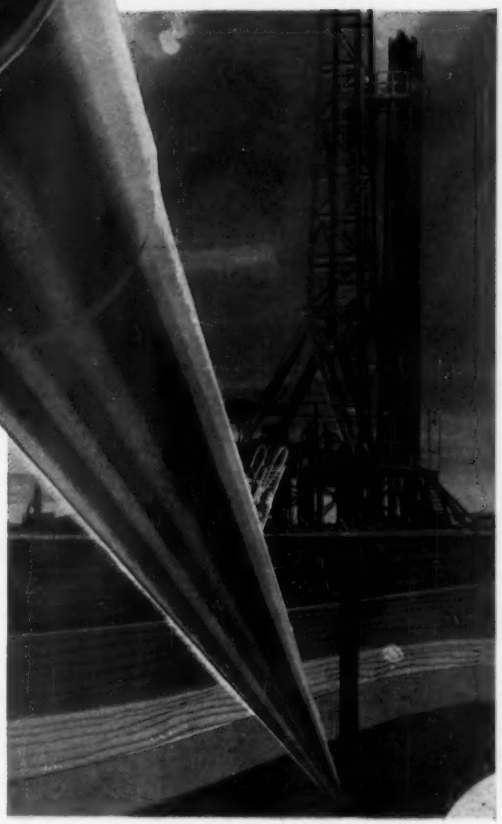

LIGHTWALL... LESS WEIGHT... MORE FLOW-THROUGH

Southwestern Lightwall has *earned* its reputation as the profit-pipe — earned it through greater savings in initial cost, transportation and handling, installation. The greater I.D. of Lightwall — compared to standard wall — means more flow-through, higher profits.

BIG SAVINGS IN SLIM HOLE AND MULTI-ZONE COMPLETIONS

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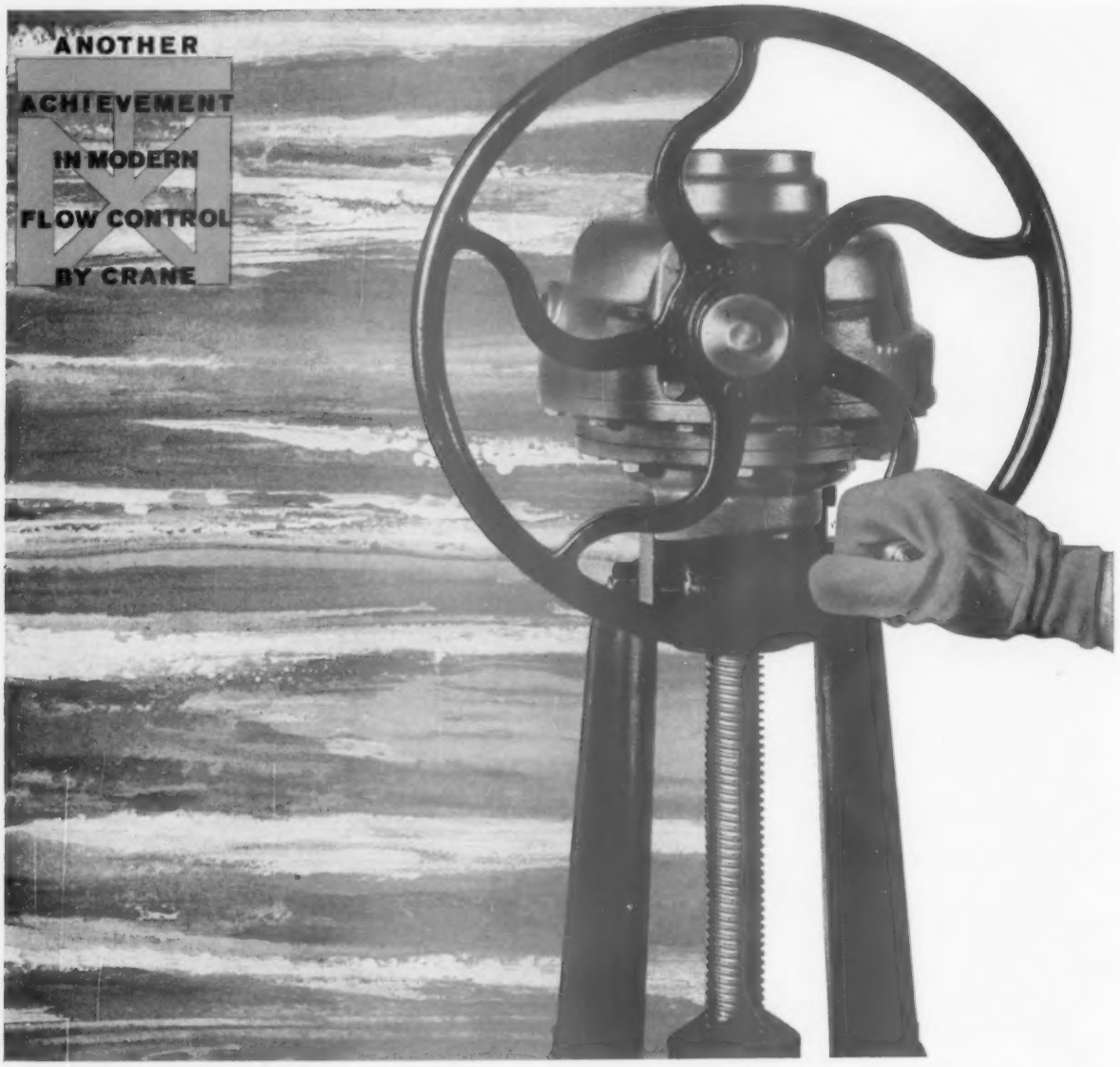


one hand can stop a river

CRANE'S NEW CONVERTO-GEAR OPERATOR

gives you torque enough to tame a torrent. In a matter of minutes, you can power up a wide range of Crane iron and steel gate valves: OS&Y's with ball-bearing or split yokes, rising and non-rising stem types with stems up to 2½-inch diameter.

Take your choice of two styles—horizontal or vertical wheel—both with spiral-cut bevel gears of carburized alloy steel yielding a 4.11 to 1 ratio in manual operation, or with portable air or electric power. Mechanical efficiency is over 95%, with three sets of ball bearings to cut friction, and the entire self-lubricating unit is rugged and weatherproof.

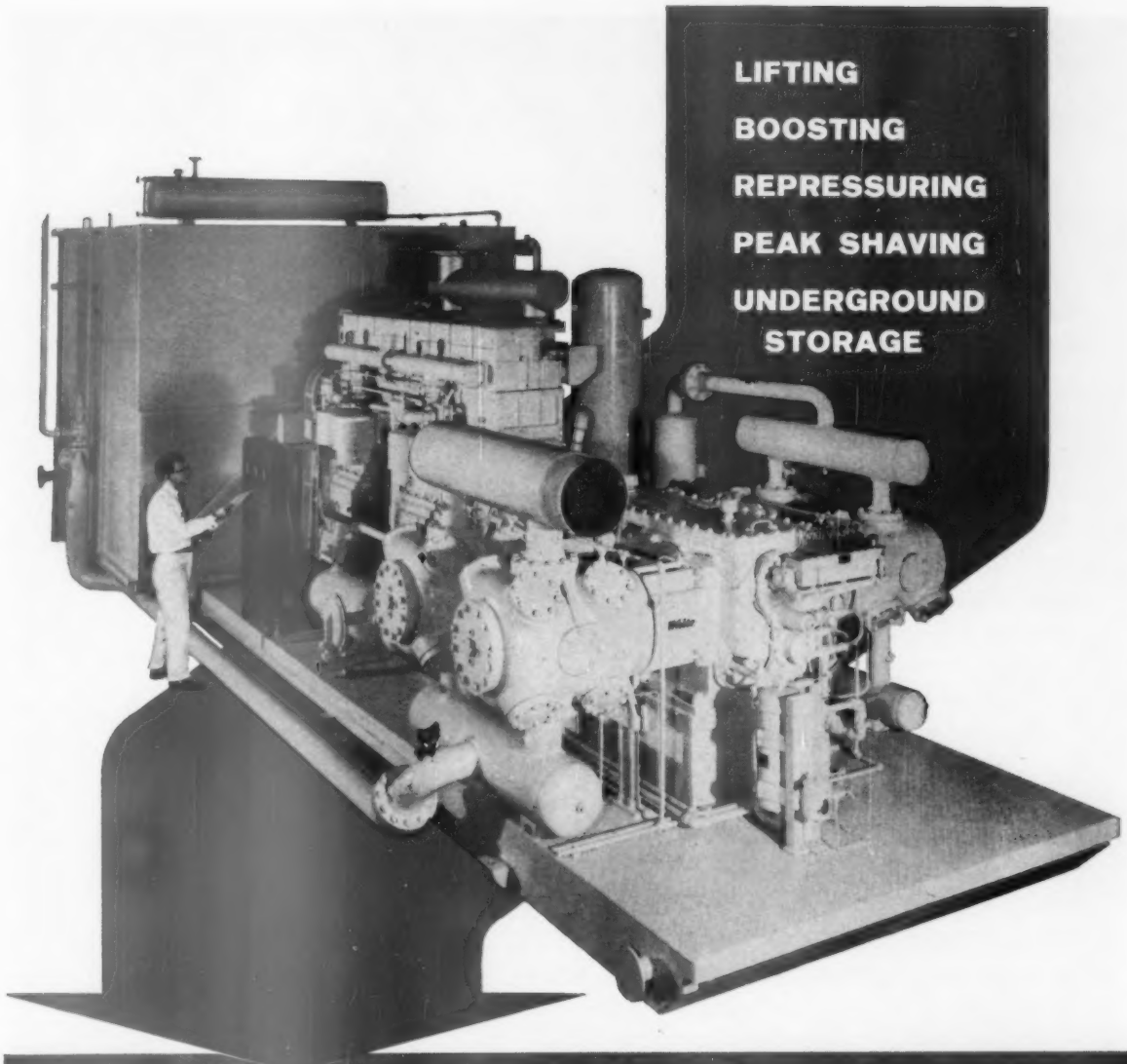
The kit is complete, for simple installation in less than 30 minutes—or your Crane Distributor can take your order now for new valves already fitted with the power-packed Converto-Gear Operator.

For complete details contact your Crane Distributor or write Crane Co., Industrial Products Group, 4100 S. Kedzie Ave., Chicago 32, Ill. In Canada, Crane, Ltd., 1700 Beaver Hall Square, Montreal.

at the heart of home and industry

CRANE

valves
piping • electronic controls
plumbing and heating
air conditioning



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WHITE-SUPERIOR 200/1000 BHP COMPRESSORS offer broad flexibility for gas company applications. They are specifically engineered for direct drive combination with medium speed Superior gas engines or electric motors and provide optimum combinations of piston speed, horsepower and service life.

Two, four and six-cylinder models offer cylinder sizes from 4000 psi, 2⅝" dia. to 85 psi, 22½" dia. providing 68 different standard cylinders. Custom sizes and designs are available.

These continuous, heavy-duty units also provide wide speed range, manual or fully automated station operation, and they can be block mounted or skidded and unitized to facilitate moves for service changes. Get complete information now . . . write for Bulletin 124. White Diesel Engine Division, Springfield, Ohio.

White DIESEL | Superior ENGINES

White Diesel

OKLAHOMA OPERATOR ESTIMATES $7,000 SAVINGS ON 19,600-FOOT WORKOVER!

And the Service Contractor made a fair profit, too!

"This modern drive-in rig saved us almost $200 per day on day work costs, plus $1,000 on moving and rig-up costs," says Mr. Jack Ross, Production Superintendent for Kenneth A. Ellison. "We waited over two weeks for the rig we wanted, a Cardwell KM250. We'd watched these rigs closely for several months and had no doubts about putting one on this tough job. The KM250 is as fast as any conventional drilling rig normally used for this deep work, and it's much more economical. On this job, the KM250 proved its superior performance and overall job economy. Because of this, we'll be using this rig a lot in the future."

The job was performed on the Miller-Long #1, which was originally drilled to 19,634 feet. On the last trip out of the hole, the 19,600 feet of pipe was pulled and on the bank in just over 8 hours, including time to change elevators. There were no breakdowns on the job which lasted 31 days, including moving, rig-up and rig-down time.

More and more operators are finding that Cardwell Drive-In Rigs save them time and dollars on completion, servicing and workover, and perform outstandingly on medium depth drilling. Contractors who own Cardwell Drive-In Rigs are continually meeting the challenge of tougher, more complex jobs, and still making a good profit for themselves. You can, too! Call a Cardwell representative today!

Mr. Jack Ross,
Production Superintendent,
Kenneth A. Ellison.

for tomorrow's equipment—see Cardwell today!

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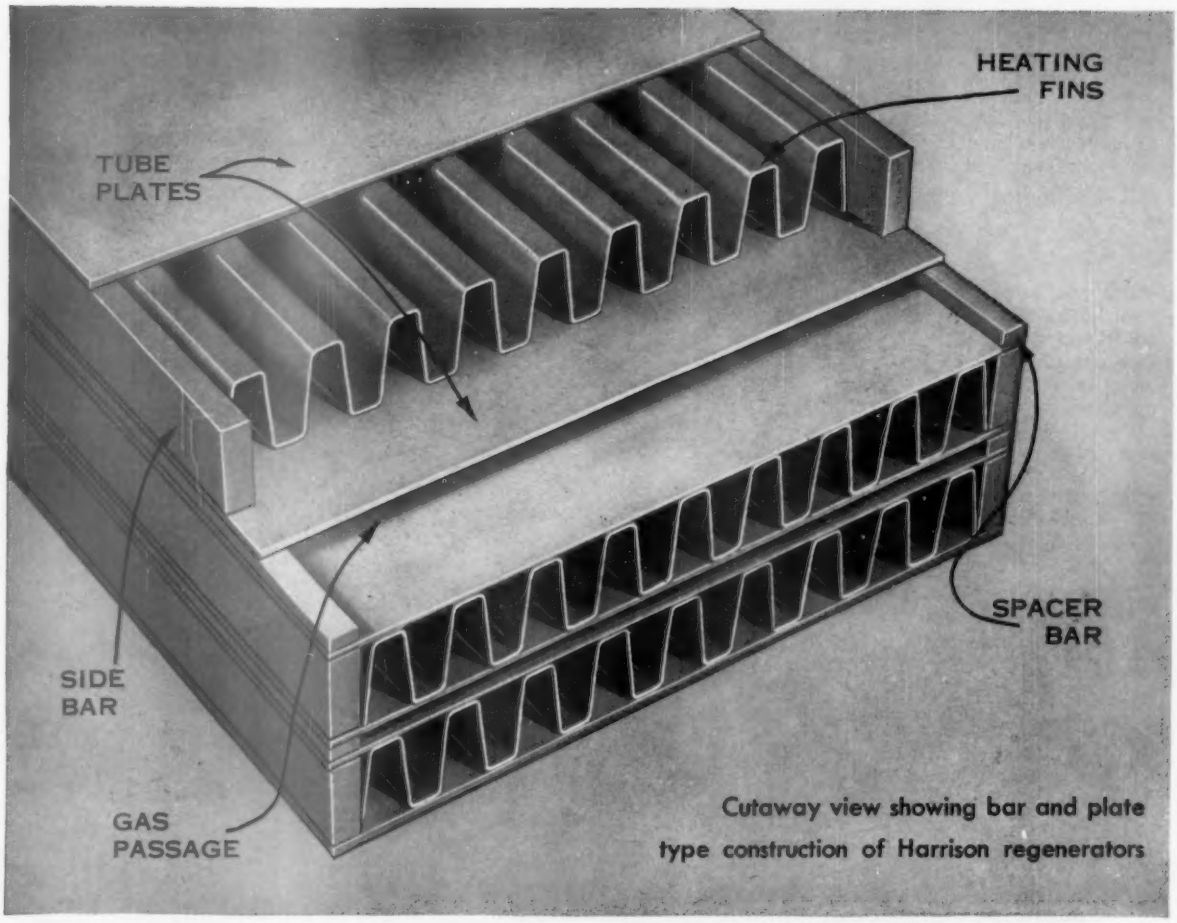


Cutaway view showing bar and plate type construction of Harrison regenerators

GM HARRISON BAR AND PLATE REGENERATOR

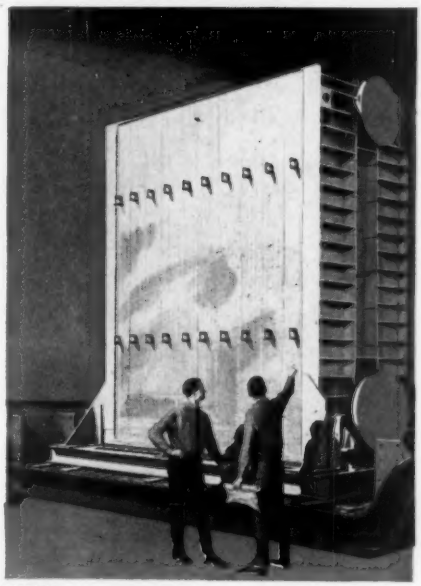
PROVIDES MAXIMUM RELIABILITY FOR GAS TURBINE INSTALLATIONS!

Saves Weight . . . Space . . . Erection Costs!

More than 500 design configurations were thoroughly analyzed by Harrison engineers before they were convinced that this type was the optimum for compactness and efficiency.

Such care pays off. For this regenerator's reduced size and lighter weight permits smaller foundations. In fact, more than a week of field erection time was saved on installations now in operation.

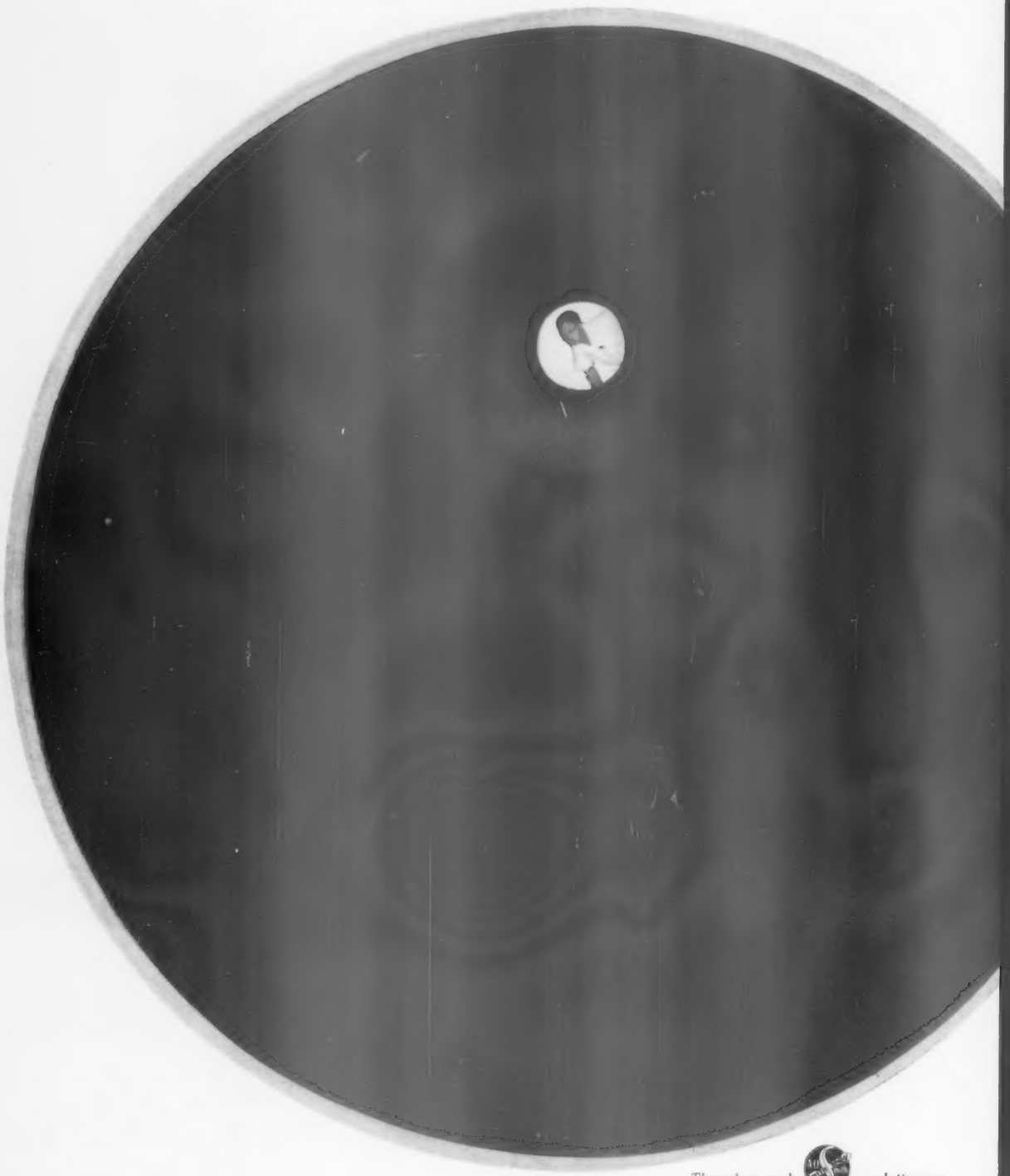
What's more, maximum reliability is designed into every component of this regenerator . . . the same "measurable excellence" that typifies all Harrison products. This kind of reliability is a direct result of Harrison's 50 years of experience in the heat transfer field, and Harrison's constant aim to make the finest possible heat exchangers.



GM HARRISON — TEMPERATURES MADE TO ORDER

AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK



Through research ...a better way

A.O.Smith
CORPORATION

TUBULAR PRODUCTS DIVISION
Milwaukee 1, Wisconsin

Chicago 4 • Dallas 35 • Houston 2 • Los Angeles 17 • Midland 5, Texas • New Orleans 12 • New York 17 • Tulsa 3 • A. O. SMITH INTERNATIONAL S. A., Milwaukee 1. Wisconsin, U. S. A.

PICKLING—All plate for A. O. Smith pipe is pickled to remove rust and mild scale. The clean surface is preserved throughout the complete pipe-making process.

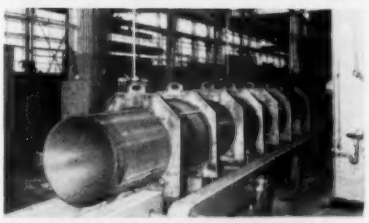
CLEANING — Wire brushing and scrubbing with a hot cleaning solution is the first step in the preparation of pipe for internal coating.

internal coating "a better way"

A. O. Smith Corporation believes that the best coating results are obtained from an originally clean, pickled surface, and that coating applied to such a surface will yield maximum benefits to the user. To this end A. O. Smith has established newly designed and fully enclosed facilities for *separate* cleaning and *separate* coating of 16″ through 36″ line pipe at both its Houston and Milwaukee plants.

These modern coating facilities are typical of A. O. Smith's ability to manufacture line pipe to exact customer specifications. For your exact coating requirements, contact the A. O. Smith sales office near you.

FLUSHING — Rotating pipe is thoroughly flushed with clean, hot water, leaving a clean, bright surface.



HEATING — Pipe is heated to a controlled level prior to the application of the internal coating.

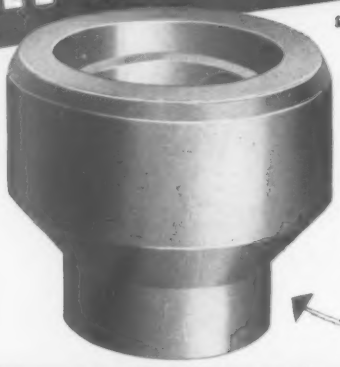
SPRAYING — Airless spray equipment is used to apply the coating in a vented, dust-free enclosure.

CURING — Residual heat accelerates curing before pipe is exposed to weather.

Another* Exclusive Vogt Product

THREADED TYPE

FORGED STEEL WELD COUPLETS

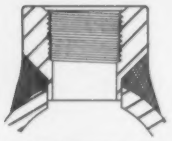


SOCKET WELD TYPE

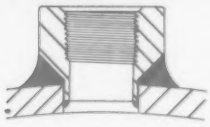
The Vogt Weld Couplet is an easy-to-install fitting for branch connections from pipe, vessels or tanks. It replaces more-difficult-to-install welding bosses, couplings and the type of fittings requiring trimming or matching to fit contour of vessel or pipe.

*with Exclusive Vogt "WELD RING"

Here's How the Exclusive VOGT "WELD RING" Saves Time and Money!



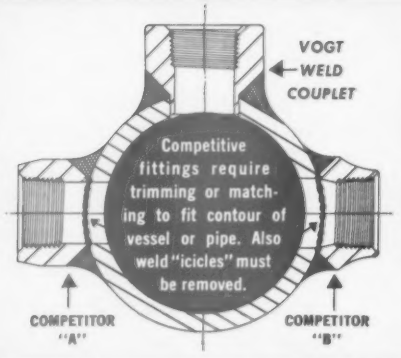
Small Diameter Pipe



Large Diameter Vessel

Vogt Weld Couplets adapt to any pipe or vessel curvature by simply adjusting the height position of the couplet when welding. This characteristic means easy installation, positive positioning and alignment, a stronger weld without distortion, and no inside "icicles" of welding material.

Couplets are available in carbon steel, conforming to A.S.T.M. specifications. Other materials can be supplied on special order.


VOGT
WELD
COUPLET
Competitive fittings require trimming or matching to fit contour of vessel or pipe. Also weld "icicles" must be removed.
COMPETITOR "A"
COMPETITOR "B"

Write for Folder SWC-1 to Dept. 24A-FO.

Vogt VALVES, FITTINGS FLANGES & UNIONS

See our complete line in Catalog F-10

HENRY VOGT MACHINE CO., P. O. Box 1918, Louisville 1, Kentucky

SALES OFFICES: Camden, N. J., Charleston, W. Va., Chicago, Cleveland, Dallas, Los Angeles, New York, St. Louis

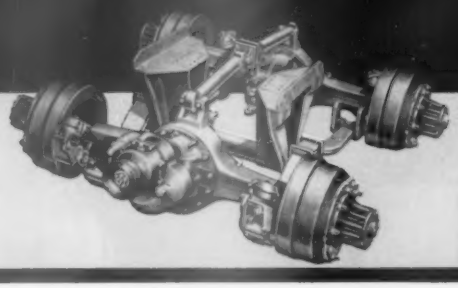
For Direct Long Distance to Louisville dial: 502 ME 4-9411

there's a ROCKWELL-STANDARD Driving Tandem for every kind of service

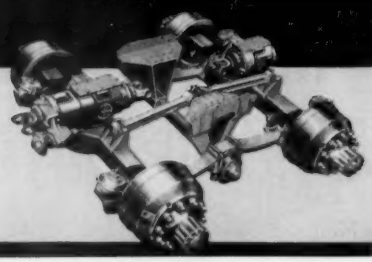
First developed by Rockwell in 1918, driving tandems offer four important advantages over single driving axles... *greater legal payload... greater traction... better flotation... smoother riding!*

Today, only Rockwell-Standard offers a complete line of driving tandem axles to meet every on-or-off highway need. Capacities are available in a range from 22,000 to 150,000 pounds—with axle ratio selection exceeding anything offered elsewhere in the industry.

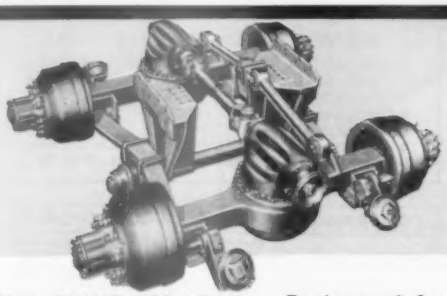
One of the four types of driving tandems below is ideally suited for your particular requirements:



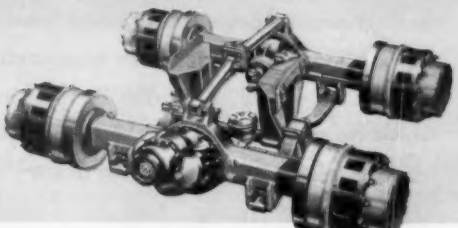
HYPOID SINGLE REDUCTION • Engineered for minimum weight and cost • Husky hypoid gearing for maximum gear strength • Axle ratios up to 8.6 to 1 • Nine models with capacities to 46,000 pounds.



HYPOID-HELICAL DOUBLE REDUCTION • Engineered for universal heavy-duty operations • Balanced hypoid-helical double reduction gearing • Wide selection of ratios • Six models with capacities up to 65,000 pounds.



WORM SINGLE REDUCTION • Engineered for simplicity of design and long life • Worm gear may be reversed to increase operating life • Four models with capacities up to 50,000 pounds.



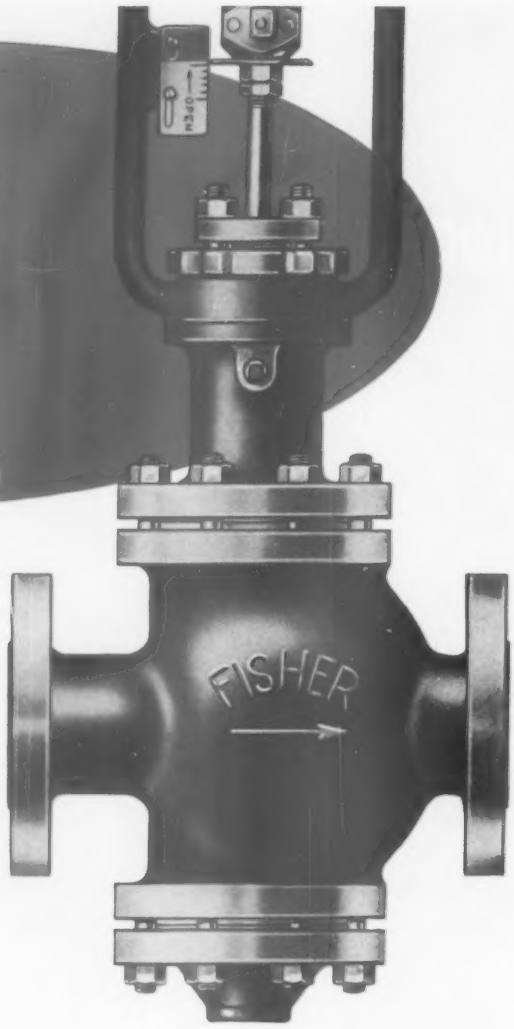
FULL PLANETARY DOUBLE REDUCTION • Engineered for extra heavy-duty operations • Planetary reduction is at wheel end for greatest mechanical advantage • Capacities up to 150,000 pounds.

Products of... **ROCKWELL-STANDARD CORPORATION**

ROCKWELL R STANDARD ®

Transmission and Axle Division, Detroit 32, Michigan

Saves up to 23% over cost of steel valves!



Fisher nodular iron control valves

Nodular Cast (ductile) Iron valve bodies have higher yield strength than steel ● Ability to resist mechanical shock compares favorably to steel ● NCI valves have been tested at three times their rated pressure ● Corrosion resistance is as good, and generally better, than cast iron or carbon steel ● Effective in temperature ranges of −20°F. to +650°F. and pressures up to 1,000 psi. ● Shock or impact characteristics are comparable to steel ●

For more information, send for Technical Paper TM-5. Fisher Governor Company, Marshalltown, Iowa. Plants in Woodstock, Ont., Rochester, England. Butterfly Valve Division: Continental Equipment Co., Coraopolis, Pa.

NCI VALVE BODY SPECIFICATIONS

Body Styles—Double or single port globe bodies • **Body Sizes**—½ through 12" • **End Connections**—Screwed, ASA raised face or RTJ 150 to 600 psi flanges • **Plug Style**—Top and Bottom guided, V-Pup or Throttle Plug • **Pressure**—Temperature Ratings—Pressure 80% of corresponding steel flanges at a given temperature with maximum pressure up to 1,000 psi and maximum temperature 650°F. **Minimum Temperature**—Minus 20°F.

COMPARISON OF MECHANICAL PROPERTIES

	Cast Iron ASTM A126-B	Nodular Iron ASTM A395	Cast Steel ASTM A216-WCB
Tensile Strength, PSI	31,000 Min.	60,000 Min.	70,000 Min.
Yield Strength, PSI	———	45,000* Min.	36,000 Min.
Elongation, % in 2" Gage Length	NIL	15	22
Modulus of Elasticity, PSI	12—20x10⁶	24x10⁶	30x10⁶

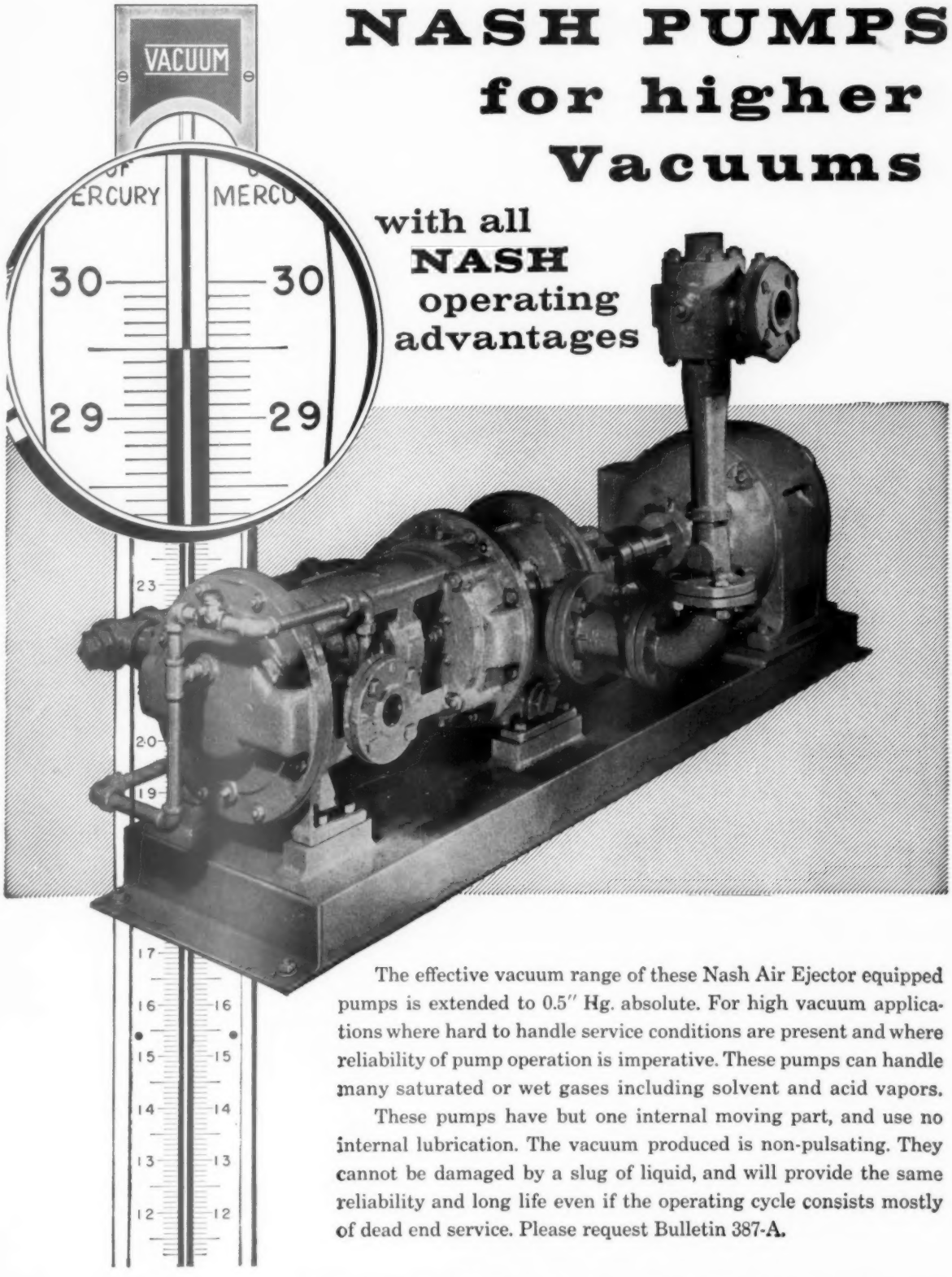
*0.2% Offset

If it flows through pipe anywhere in the world ...chances are it's controlled by.....

FISHER® Controls SINCE 1880

NASH PUMPS for higher Vacuums

with all **NASH** operating advantages



The effective vacuum range of these Nash Air Ejector equipped pumps is extended to 0.5″ Hg. absolute. For high vacuum applications where hard to handle service conditions are present and where reliability of pump operation is imperative. These pumps can handle many saturated or wet gases including solvent and acid vapors.

These pumps have but one internal moving part, and use no internal lubrication. The vacuum produced is non-pulsating. They cannot be damaged by a slug of liquid, and will provide the same reliability and long life even if the operating cycle consists mostly of dead end service. Please request Bulletin 387-A.

NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.

PIPE

The Orange Bands of Youngstown mark the world's most complete line of Oil Country Tubular Goods

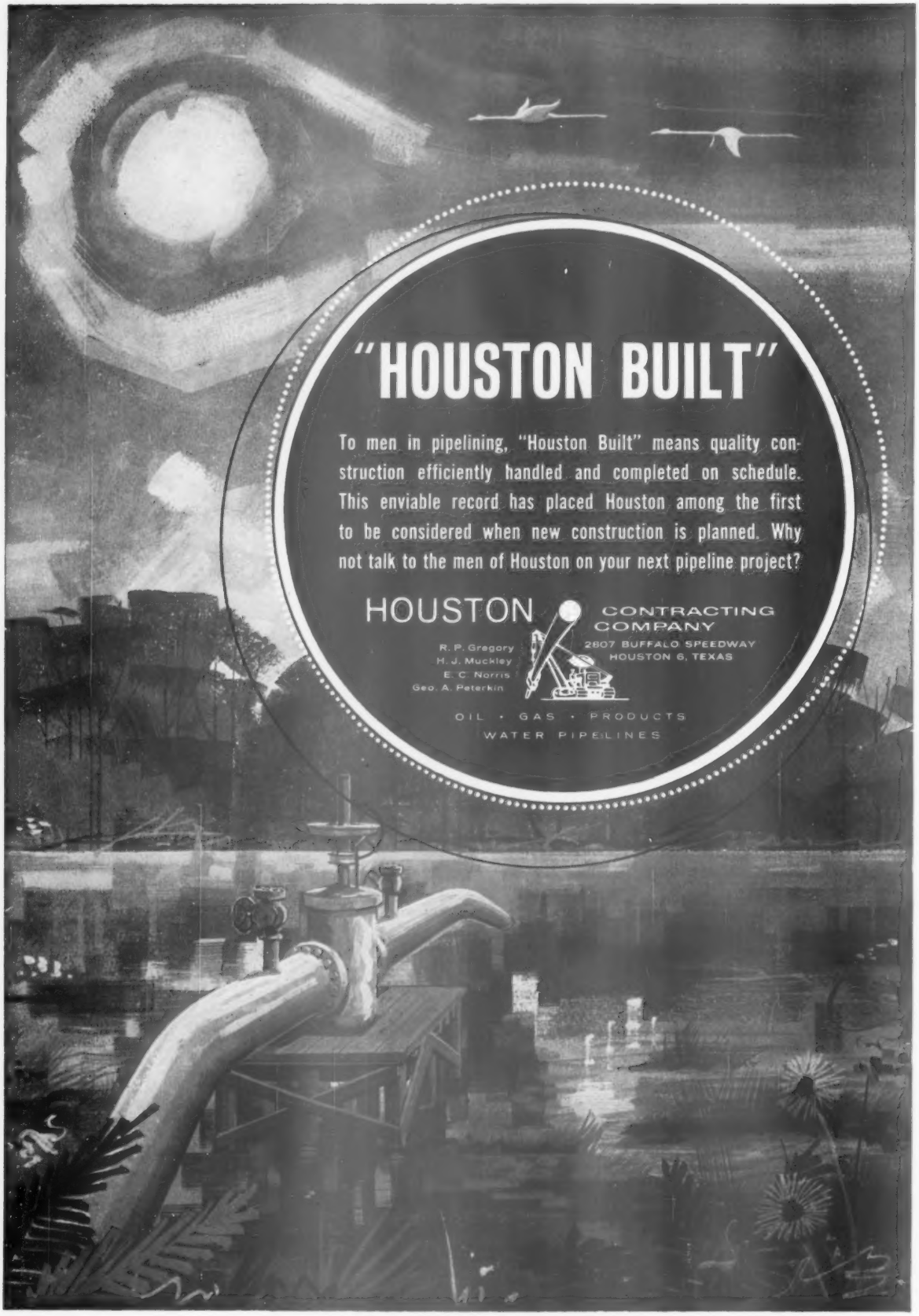
Take a mountain side. An offshore rig. Or a far out desert site. Take a tough, deep hole. A multiple completion. Or a sandy well. Wherever oil is, bring it in better with Youngstown Orange Band pipe. Bring it in more profitably with Youngstown . . . the world's most complete line of Oil Country Tubular Goods. You get exactly the pipe you need to meet any situation and every condition.

Select Youngstown drill pipe in standard or lightweights . . . 8 sizes, standard or premium grades . . . compatible with all tool joints. Order Orange Band casing in the widest range of sizes and grades. A.P.I. and Buttress T&C or Speedtite and Extreme Line integral joints. Specify Youngstown tubing from a complete line of sizes, grades, end finishes in A.P.I. or special non-A.P.I. upsets.

Orange Band quality is carefully controlled from ore to steel to final inspection by Youngstown specialists. And the largest field service engineering team in the Oil Country is ready to help you use it. You get fast delivery, too, from in-transit and full mill stocks. Specify high quality pipe from Youngstown for your next drilling job. The bold, bright Orange Bands tell you, you can't buy better.

Youngstown – growing force in steel

For details on Youngstown Orange Band tubular goods, write: Dept. 2-B,
The Youngstown Sheet and Tube Company, Youngstown, Ohio


"HOUSTON BUILT"
To men in pipelining, "Houston Built" means quality construction efficiently handled and completed on schedule. This enviable record has placed Houston among the first to be considered when new construction is planned. Why not talk to the men of Houston on your next pipeline project?
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CONTRACTING COMPANY
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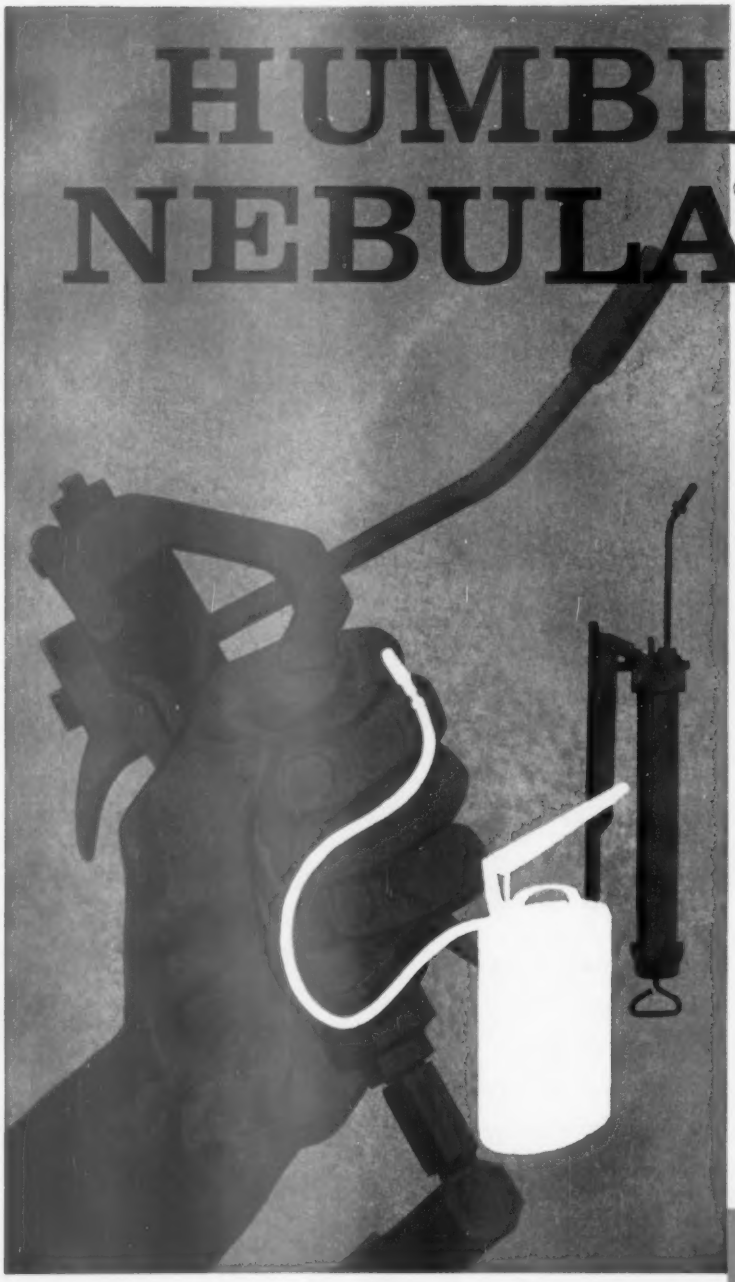
HOUSTON 6, TEXAS
OIL • GAS • PRODUCTS
WATER PIPELINES

First basic improvement in multi-use grease...

HUMBLE NEBULA® EP-1



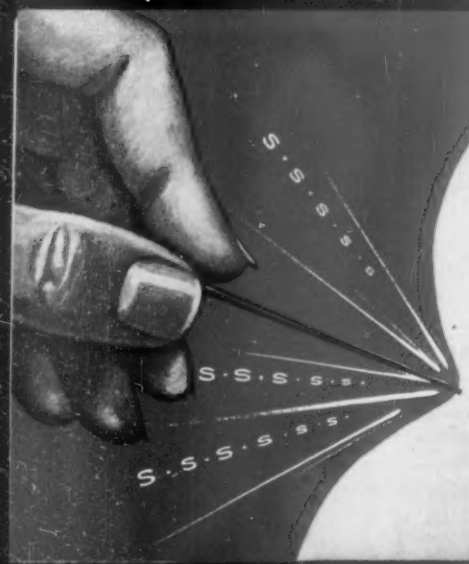
Now you can buy a *multi-use* grease that generally outperforms most *special purpose* greases! Humble NEBULA EP-1 is especially developed for tough jobs — where heat, water, oxidation or heavy loads have previously limited the use of a multi-use grease. The unique formula of NEBULA EP-1 gives superior equipment protection . . . with all the economies you expect from multi-use grease. Order NEBULA EP-1 from your nearest Humble bulk plant, or call Humble Oil & Refining Company, Houston, Texas.

NEBULA EP-1 offers these economies:

- *One* grease bought in quantity — at quantity discounts.
- Reduced inventory and handling
- The *right* grease always handy

America's Leading ENergy COmpany

HUMBLE



Pinholes are fatal in pipe protection, too!

• Electrical Inspection (arrow) is provided during processing of pipe. This automatically inspects the coating as it is applied, and guards against all "holidays" in the protection.

Pipe Line Service Methods eliminate costly failures of hit-or-miss pipe coating

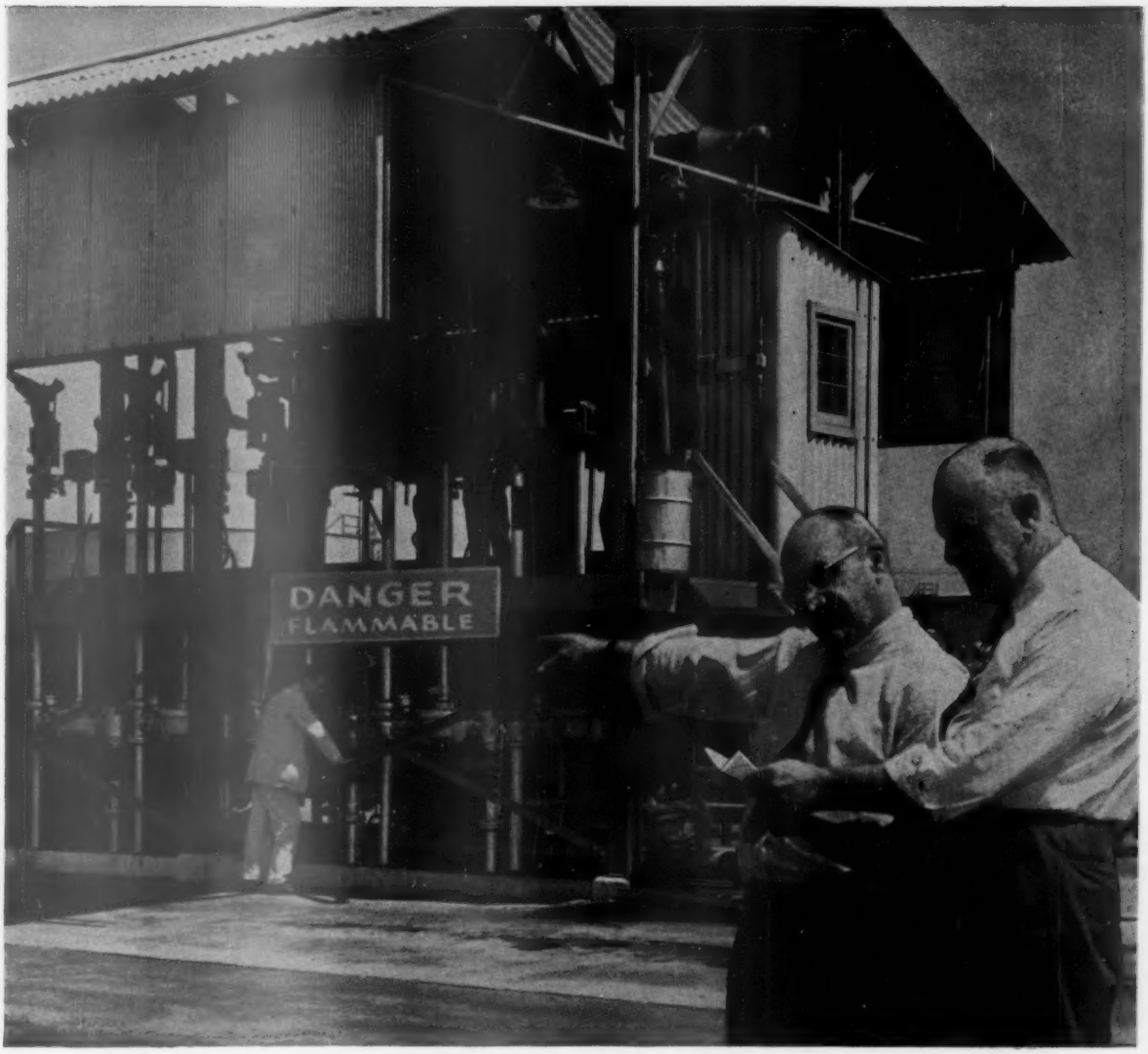
Electrical Inspection is another PLS control for unvarying quality. This steel mesh screen, designed by PLS Engineers, is charged with thousands of volts. Every square inch of coated pipe passes under this screen and is electrically tested. When voids or holidays in the coating do occur, they are immediately detected and properly repaired. Scientific thoroughness by PLS provides you with uniform protection on every pipe length. Get full details from the Pipe Line Service sales office nearest you.

Sales offices at all plant locations . . . and
Atlanta, Georgia—Dallas, Texas
Lincoln, Nebraska—Houston, Texas
Syracuse, New York

Pipe Line Service Corporation

General Offices and Plant: Franklin Park, Ill.

Quality pioneers in coating and wrapping pipe for a quarter century



"Am I glad I had him make a check! He found four electrical explosion hazards!"

"Saved us money, too. When we planned on moving our pump motors outdoors, I thought we'd need the same kind of explosion-proof electrical equipment we had indoors. Turns out we don't . . . because we're moving from a Class I Division 1 to a Division 2 location, under the National Electrical Code. The Crouse-Hinds man caught that . . . and it saved us *plenty*.

"No telling what he saved us on our other plans, though. Maybe our lives. We wanted to convert a room into a control center, complete with valves, flow meters, and so on. The Crouse-Hinds man found four spots that needed Division 1 equipment *that we'd overlooked*.

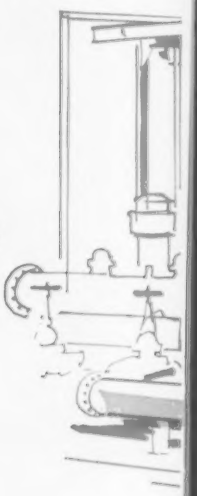
"The point is . . . it takes a specialist to tell the difference. I know *we'll* never change our explosion-proof electrical equipment around again without calling in the Crouse-Hinds man . . . first."

A Crouse-Hinds field representative will be glad to look over your new plans or present plant. And he'll recommend exactly the right equipment for each area . . . drawing on the broadest line of explosion-proof electrical equipment in the world.

Just call any office below.

CROUSE HINDS
SYRACUSE NEW YORK

OFFICES: Atlanta Baton Rouge Birmingham Boston Buffalo Charlotte Chicago Cincinnati Cleveland Corpus Christi Dallas Denver Detroit Houston Indianapolis Kansas City Los Angeles Milwaukee New Orleans New York Omaha Philadelphia Pittsburgh Portland, Ore. St. Louis St. Paul Salt Lake City San Francisco Seattle Tulsa Washington
RESIDENT REPRESENTATIVES: Albany Baltimore Reading, Pa. Richmond, Va.
Crouse-Hinds of Canada, Ltd., Toronto, Ont. Crouse-Hinds-Domex, S. A. de C. V. Mexico City, D. F. Peterco, Sao Paulo, Brazil

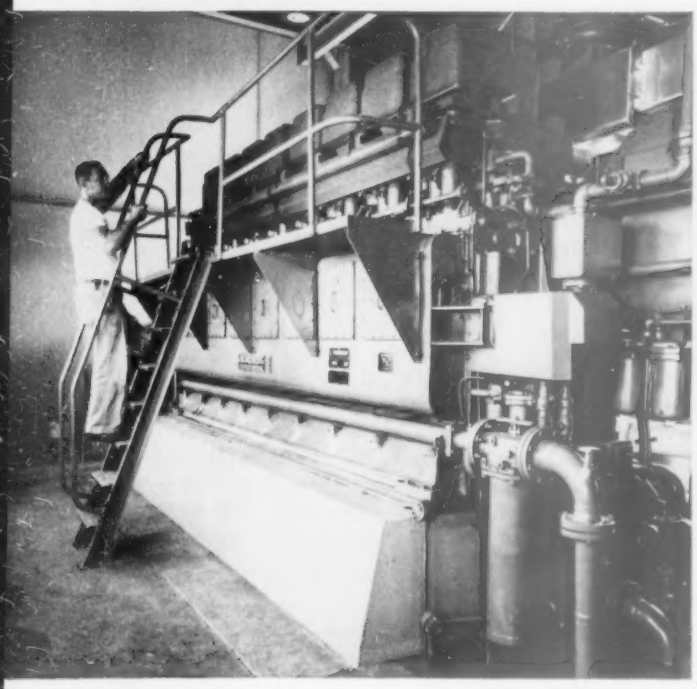


NORDBERG ENGINES

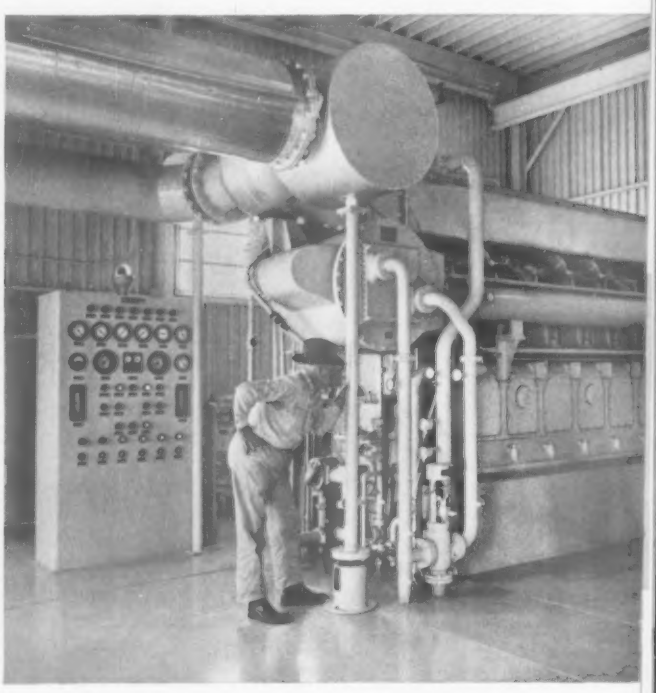
Pay Off in long term Pipe Line Service

For over forty years, Nordberg—Busch-Sulzer has been building engines for major pipe line companies. This specialized experience enables Nordberg to recommend applicable engine types . . . for operation as diesel, dual-fuel and spark-ignition gas units . . . whatever fuel best suits your pumping operations on crude or products pipe lines.

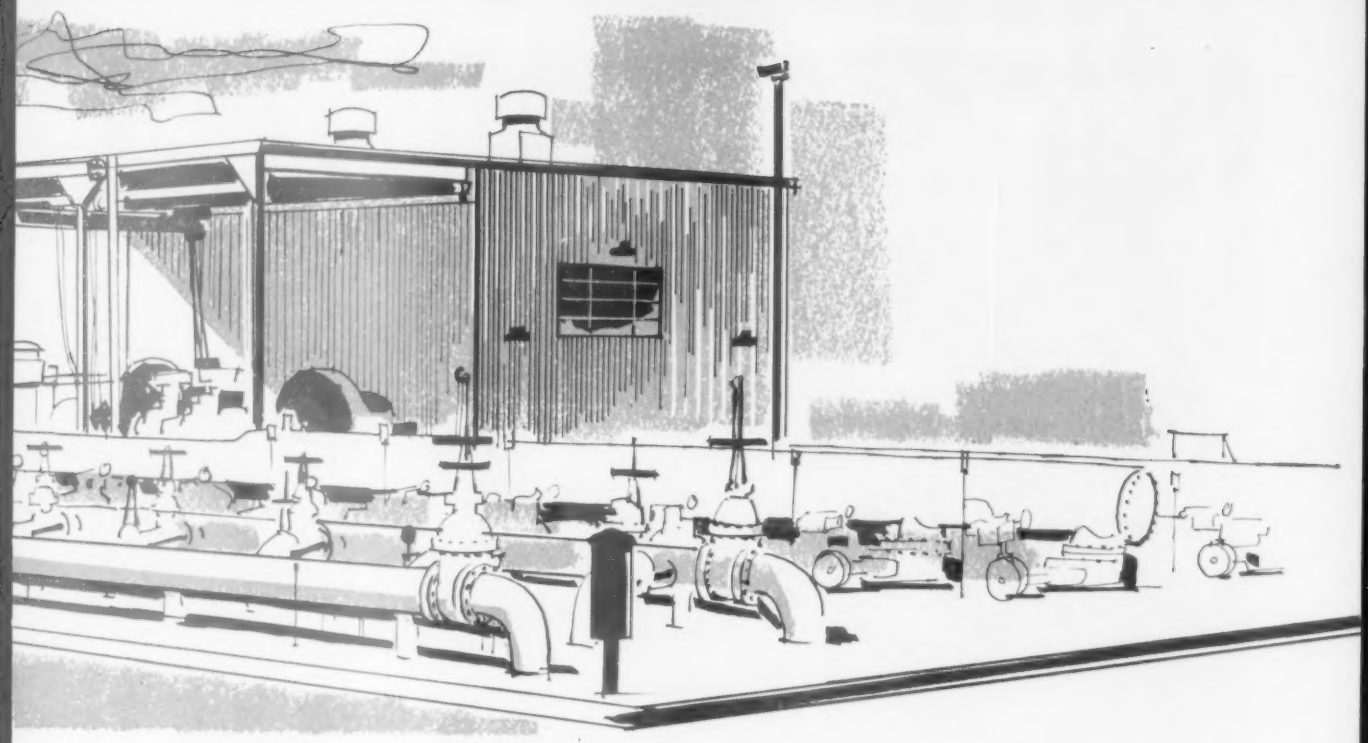
Nordberg Pipe Line Engines have compiled a record of ruggedness, day-after-day dependability, low fuel consumption and low transmission costs year after year.



This remote-controlled 1750 hp Nordberg diesel serves the Texas Eastern Transmission Corporation booster station near Lafayette, Indiana.



One of two Nordberg 2000 hp dual-fuel engines lease-rented by Sinclair Pipe Line Company, to serve its Teague, Texas main line station.



Require simple, low cost buildings

Nordberg engine installations do not require expensive, complex station arrangements. Simple sheet metal construction is all that is required. Pumps, gears and auxiliaries can be installed outside, utilizing one supporting wall as a firewall.

Remote control "Push-Button" operation

Many Nordberg Pipe Line Engines are operating in automatic, unattended, remote controlled stations.

High thermal efficiency —low fuel cost

Nordberg Pipe Line Engines are noted for high thermal efficiencies and, consequently, low fuel costs. You are also your own "customer" when you use your own fuel.

Lease-rent for immediate payout

To offset higher initial costs of engine stations, Nordberg engines, pumps and all other mechanical equipment can be lease-rented. In fact, this method provides the lowest initial cost of any pipe line pumping arrangement.

75th ANNIVERSARY 1886-1961

NORDBERG MANUFACTURING COMPANY • Milwaukee 1, Wis.

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS
NEW YORK • PHOENIX • ST. LOUIS • SAN FRANCISCO • TAMPA • WASHINGTON • WICHITA, KAN.
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0261

JUST LIKE MONEY IN THE BANK

Save as you store volatile liquids in General American conservation structures

General American fabricates tanks with every type of floating roof, tanks with lifter roofs, dry-seal gasholders and vapor balancers that will pay for themselves with the product they save.

Two outstanding seals—the Wiggins Safety Seal, safest, surest seal you can buy, and EverSeal, a solid cushion seal especially made for "problem" liquids — are offered with the floating roofs.

Skilled field crews of General American and subsidiaries are available to erect these structures where you require them.

Write for General American Bulletin No. PW-1059 for descriptive details.

General American Floating Roofs
Hidek
Lodek
Double Deck
Annular Pontoon
Pan

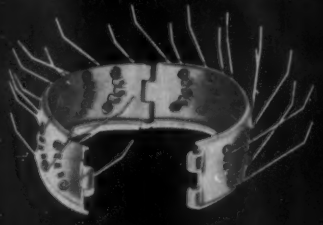
General American Floating Roof Seals
Wiggins Safety Seal
EverSeal

Other conservation structures
Lifter Roof Tanks
Dry Seal Gasholder
Vapor Balancer
Atmospheric Pressure-Refrigerated Storage Tank

PLATE & WELDING DIVISION GENERAL AMERICAN TRADE MARK

Plate and Welding Division
GENERAL AMERICAN TRANSPORATION CORPORATION
135 South LaSalle Street
Chicago 3, Illinois
Offices in principal cities

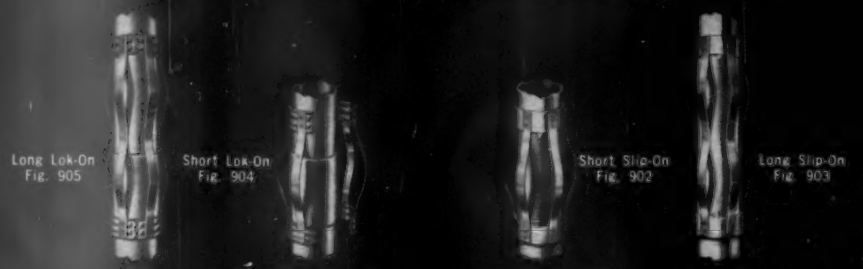
THE NEW LARKIN SCRATCHER . . .



combines all the outstanding features proved best for effective performance

+

LARKIN CENTRALIZERS . . .

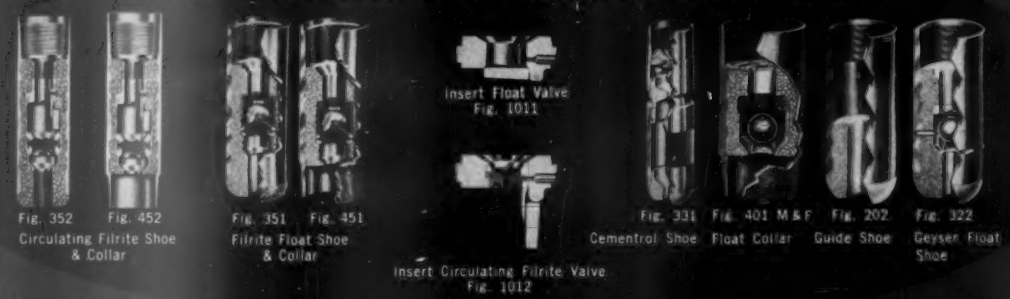


which exceed all known requirements for centralizer performance

+

A complete line of

LARKIN FLOATING & GUIDING EQUIPMENT



=

a complete equipment package for successful primary cementing from one dependable source

LARKIN

...Through Your Supply Store

LARKIN PACKER COMPANY

DIVISION KOEHRING COMPANY

WAXAHACHIE, TEXAS

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

They Say—

Rumor in need of an answer

Dear Sir:

The statement was made before the Lexington, Ky., Rotary Club recently that certain foreign students from India have reported that international and American owned and controlled oil companies did a considerable amount of geological work and drilling in India only to report that no oil was discovered and that subsequently Russian geologists and drillers came into India and in a search for oil in the same area succeeded in finding oil, the implication being, of course, the the American and international companies did not wish to reveal the discovery of oil but instead preferred to import oil from Iran and other Near East countries in which they already owned and controlled production.

I cannot believe this to be true, but I am wondering if you do not have someone on your staff who might deny it more intelligently than I can.

I have, for many years, heard from all parts of the United States how oil has been discovered and then the wells capped for one reason or another.

My own experience has been that regardless of who finds oil where, it is never capped except for possibly a short time and, of course, this is my own thinking as to the situation in India. Then, too, I have not read in The Oil and Gas Journal (although I may have overlooked it) that Russia or anyone else has found any quantity of oil in India.

W. V. Alford
McDonald, Alford & Rozzell
Lexington, Ky.

The whole idea that American companies have found oil in India and are concealing it is ridiculous. But, such rumors often crop up wherever commercial oil is not found. This is the situation in India: Standard-Vacuum last year called a temporary halt after drilling 10 dry holes, several of them deep tests, and spending over $14.5 million without finding any com-

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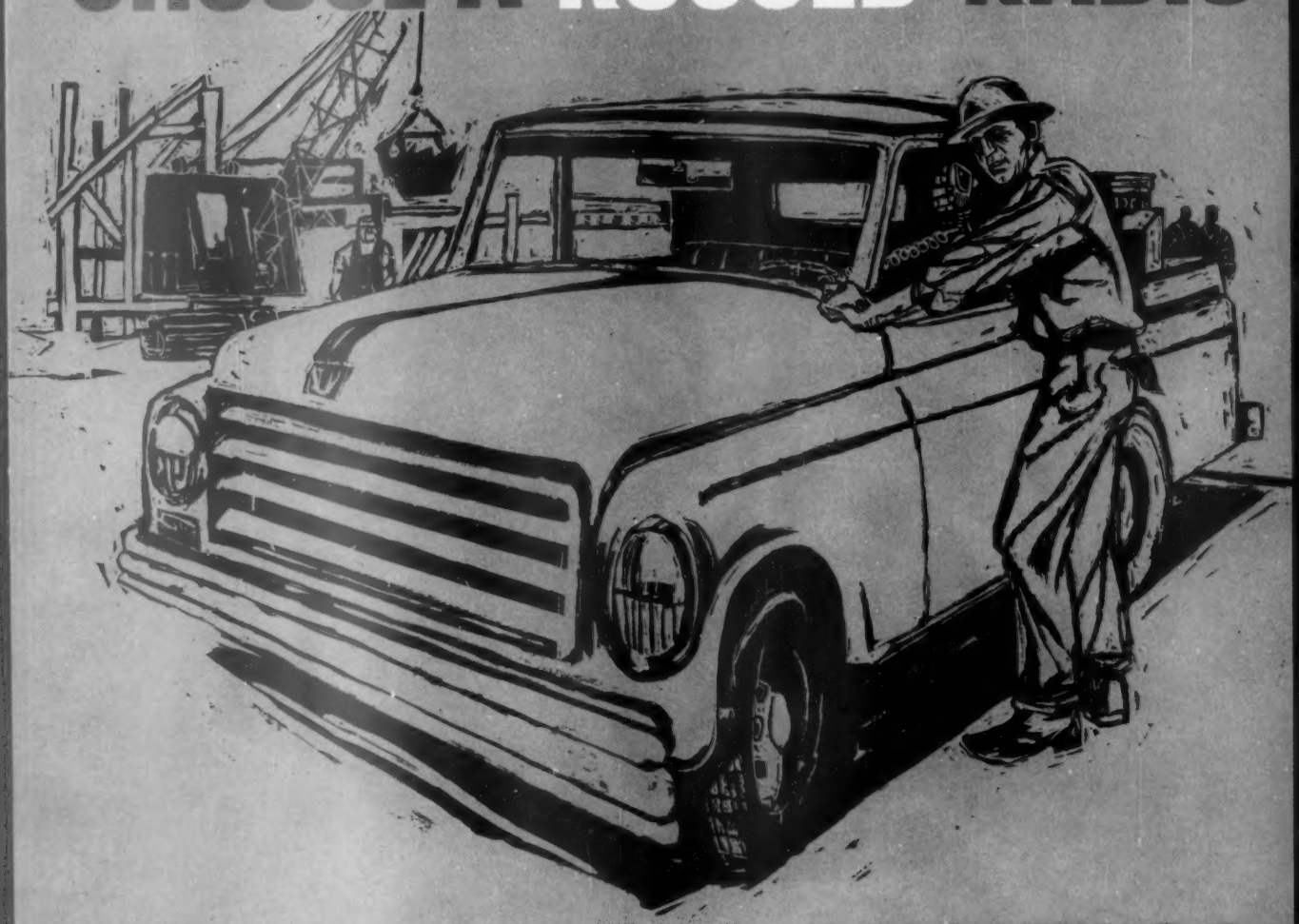

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mercial oil on its Indian concession in the West Bengal basin.

This area is just as far from where the Russians are working in India as Los Angeles is from New York. The Russians have never done any work in this region so how could they have found any oil where the Americans couldn't?

Russian and Romanian technicians have apparently found some commercial production in the Cambay and Ankleshwar regions of India north of Bombay on the northwestern coast—an area which had not been tested by anyone, American companies or otherwise, before a Romanian-Russian crew began operations there in 1958. There is an active drilling program in this area now but it is too early to predict ultimate success.

India's only commercial production at present is in the Upper Assam area. Production was established here by the British in the 1890's and a British company recently found a prolific new series of fields in the area.

Stanvac, incidentally, is now dickering with India for additional concessions on which to spend more money. Would they spend another $15 million to find some oil just so they can conceal it from the Indians?—Ed.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

APRIL

30-May 2 Independent Petroleum Association of America, midyear meeting, Roosevelt Hotel, New Orleans.

30-May 3 Liquefied Petroleum Gas Association, convention and trade show, Conrad Hilton Hotel, Chicago.

MAY

2-4 Purdue University, School of Civil Engineering, sixteenth industrial-waste conference, Purdue Memorial Center, Lafayette, La.

3-5 American Petroleum Institute, Division of Production, Rocky Mountain district meeting, Gladstone, Henning, and Townsend hotels, Casper, Wyo.

4-5 Society of Petroleum Engineers of AIME, oil recovery conference, Midland, Tex.

4-5 Pacific Coast Gas Association, Inc., transmission conference, Biltmore Hotel, Santa Barbara, Calif.

4-5 Illinois State Geological Survey, Illinois Basin chapter of AIME's Society of Petroleum Engineers, biennial petroleum engineering conference, University of Illinois campus, Urbana.

5-7 Indiana Geological Survey, Indiana Department of Conservation, University of Indiana department of geology, tenth geologic field conference, stratigraphy of the Silurian rocks of northern Indiana, Marion, Ind.

7-10 American Institute of Chemical Engineers meeting, Sheraton-Cleveland Hotel, Cleveland.

8-11 American Petroleum Institute, Division of Refining, midyear meeting, Rice Hotel, Houston.

8-12 American Gas Association, distribution and production conference, Sheraton Hotel, Philadelphia.

9-11 Western Joint Computer Conference and Exhibit, Ambassador Hotel, Los Angeles.

10-12 American Society of Mechanical Engineers, production engineering conference, Royal York Hotel, Toronto.

10-12 Canadian Institute of Mining and Metallurgy, oil and gas division, and Calgary and Edmonton petroleum engineering sections of Canadian Institute of Mining and Metallurgy and American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, McDonald Hotel, Edmonton, Alta.

11 Panhandle Producers and Royalty Owners Association, annual meeting, Herring Hotel, Amarillo, Tex.

11 Texas Petroleum Research Committee, thirteenth oil recovery conference, Memorial Student Center, Texas A & M College, College Station, Tex.

11-12 American Petroleum Institute, Division of Production, Pacific Coast

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district meeting, Biltmore Hotel, Los Angeles.

11-12 Texas A. & M. College, thirteenth oil recovery conference, College Station, Tex.

12 Natural Gasoline Association of America, Permian basin regional meeting, Lincoln Hotel, Odessa, Tex.

14-17 Texas Independent Producers and Royalty Owners Association, Scharbauer Hotel, Midland, Tex.

16-19 American Petroleum Institute, Division of Marketing, midyear meeting, Americana Hotel, Miami Beach.

17-19 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

17-19 Society of Professional Well Log Analysts, second annual meeting and logging symposium, Sheraton-Dallas Hotel, Dallas.

19-21 Michigan Basin Geological Society, annual field trip, western portion of Michigan's northern peninsula.

21-24 American Petroleum Institute, Division of Transportation, midyear highway conference, Bellevue Stratford Hotel, Philadelphia.

22-25 Design Engineering Show, Detroit, Mich.

24-25 Western Petroleum Refiners Association, computer conference, Ben Franklin Hotel, Philadelphia.

25 Pennsylvania Grade Crude Oil Association, Bradford District Pennsylvania Oil Producers Association, joint annual meeting, Pennhills Club, Bradford, Pa.

25-26 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual Rocky Mountain petroleum sections, joint meeting, Farmington, N. M.

25-26 American Gas Association, gas transmission conference, Brown Palace and Cosmopolitan Hotels, Denver.

28-June 2 Special Libraries Association, petroleum section meeting, San Francisco.

JUNE

1-2 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

1-3 Interstate Oil Compact Commission midyear meeting, Shamrock - Hilton Hotel, Houston.

5-6 Petroleum Electric Power Association, meeting, Mayo Hotel, Tulsa.

6-8 Instrument Society of America, summer instrument - automation conference and exhibit, Royal York Hotel and Queen Elizabeth Hall, Toronto.

6-8 Sixth annual Appalachian underground corrosion short course, West Virginia University, School of Mines, Morgantown, W. Va.

9-17 European Congress of Chemical Engineering and Achema Congress, thirteenth exhibition and congress of chemical engineering, Frankfurt am Main, Germany.

11-15 American Society of Mechanical Engineers, summer annual meeting, Statler Hilton Hotel, Los Angeles.

11-16 American Petroleum Institute, Division of Production, midyear committee conference, St. Francis Hotel, San Francisco.

12 Instrument Society of America and Air Pollution Control Association, air pollution instrumentation symposium, Hotel Commodore, New York City.

12-14 American Petroleum Institute, Division of Transportation, annual tanker conference, Oyster Harbors, Cape Cod, Mass.

12-16 Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

13-16 Instrument Society of America, biennial international gas chromatography symposium, Kellogg Center, Michigan State University, East Lansing, Mich.

19-23 Harvard University, School of Public Health, air cleaning institute, Cambridge, Mass.

19-23 Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

20-22 National Association of Corrosion Engineers, Greater Boston section, corrosion short course, Wentworth Institute, Boston.

20-24 Canadian Gas Association, annual meeting, Banff Springs, Alta.

22-24 American Association of Petroleum Landmen, annual meeting, Shamrock Hilton Hotel, Houston.

25-30 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

26-27 Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.

26-July 7 Massachusetts Institute of Technology, summer program on dynamics and control of chemical engineering processes, Cambridge, Mass.

28-30 International Gas Conference, Stockholm, Sweden.

28-30 Instrument Society of America, joint automatic control conference, Boulder, Colo.

JULY

4-7 National Society of Professional Engineers, twenty-seventh annual meeting, Olympic Hotel, Seattle.

6-8 International Oil Scouts Association,

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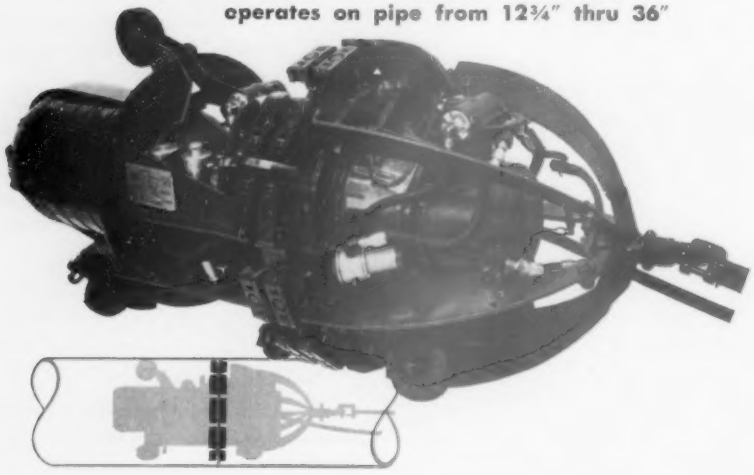

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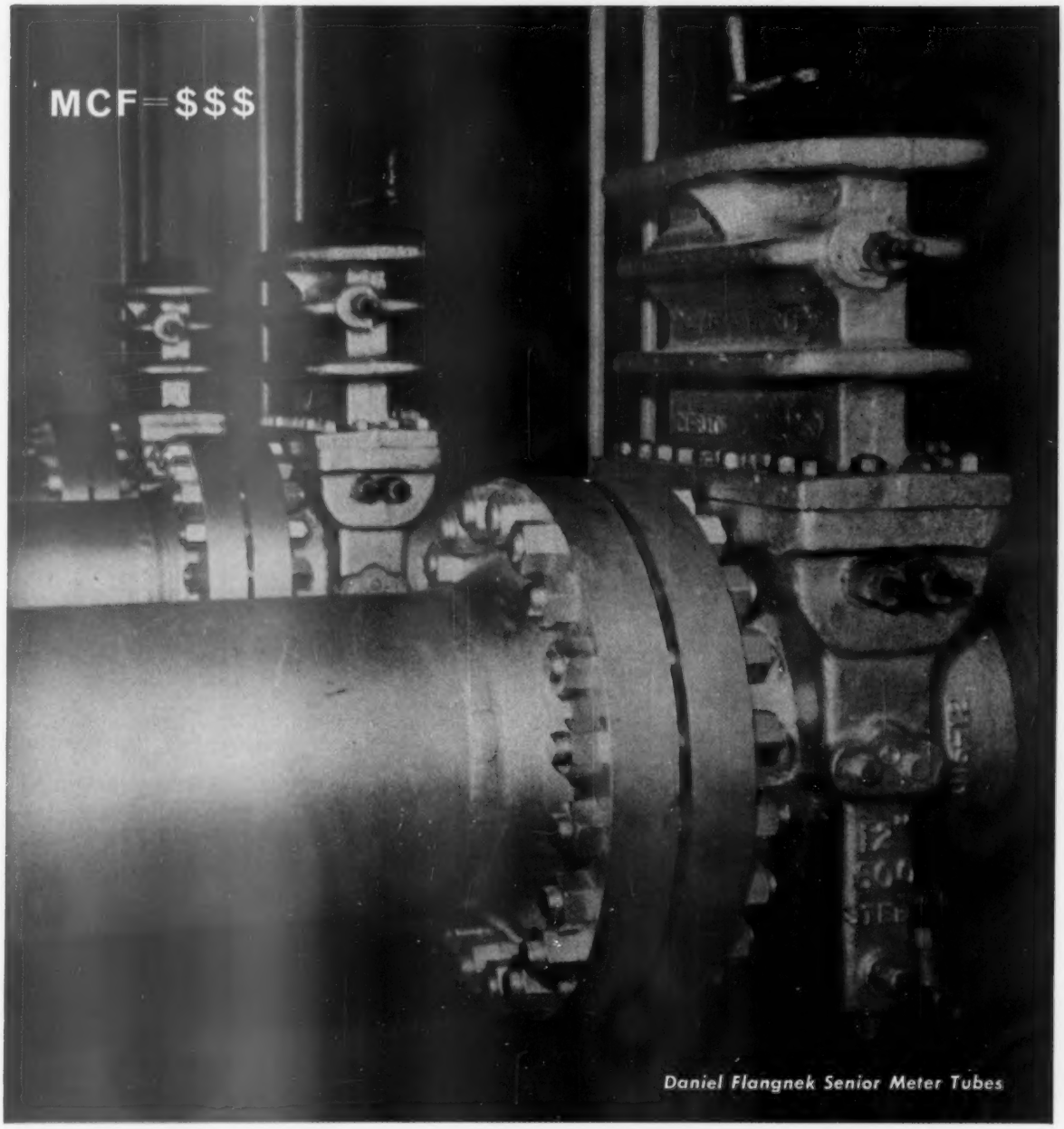

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annual meeting, Roosevelt Hotel, New Orleans.

10-21 University of Michigan, summer course on underground storage of natural gas, Ann Arbor, Mich.

26-28 American Petroleum Institute, Division of Production, eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

2-4 Wyoming Geological Association, sixteenth annual field conference, Green River, Wind River, and Powder River basins.

28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference, Boulder, Colo.

SEPTEMBER

5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.

7-9 Magic Plains Oil Exposition, Borger, Tex.

11-15 Instrument Society of America, fall instrument-automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.

12-13 American Gas Association, Southern Gas Association, annual accident prevention conference, Statler Hilton Hotel, Dallas.

13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.

13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

14 Natural Gasoline Association of America, Rocky Mountain regional meeting, Northern Hotel, Billings, Mont.

15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.

17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.

18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

20-21 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.

25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.

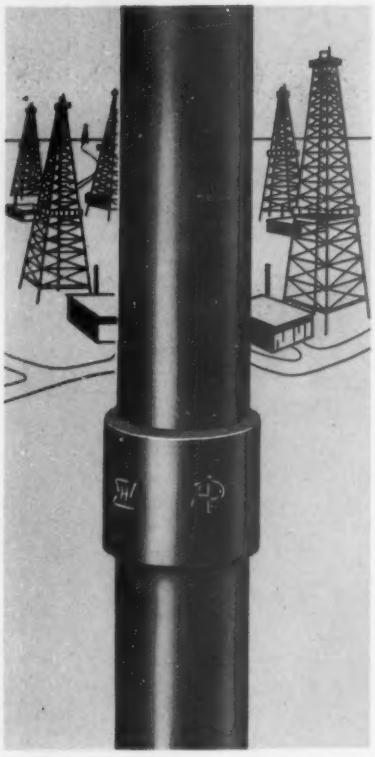
OCTOBER

1-4 American Gas Association, annual convention, Dallas.

4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.

4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.

8-11 Society of Petroleum Engineers of AIME annual fall meeting, Memorial Auditorium, Dallas.



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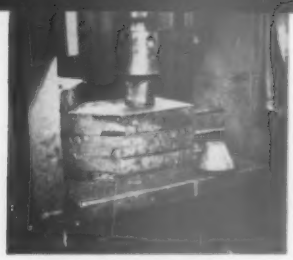

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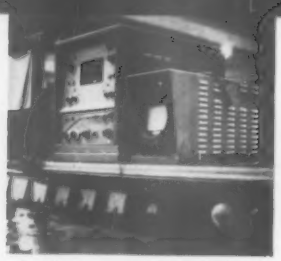

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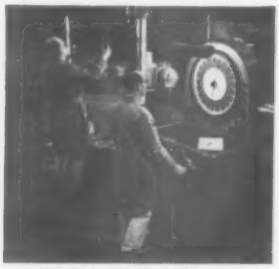

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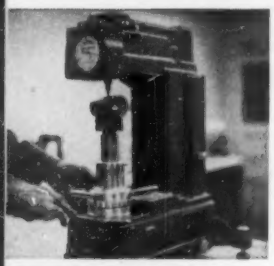

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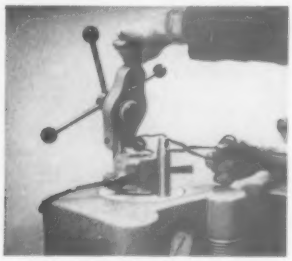

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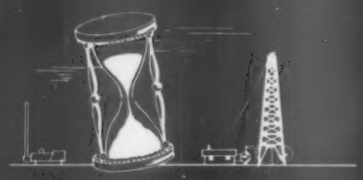

the Journal said...

50 years ago

May 4, 1911

Katalla Oil Co. and Alaska Petroleum and Coal Co., of Seattle, jointly contract with Standard Drilling Co. of Kansas City and Indianapolis for the drilling of a number of wells in the Katalla area of Alaska. Expected oil production is to be shipped to California refineries. A 37,500-bbl. tank already is being built to handle the oil.

D. W. Franchot & Co. has placed a small testing plant in operation at Kiefer, in Glen pool, Oklahoma, where oil and gas producers can witness a satisfactory demonstration of the possibilities of manufacturing gasoline from natural gas. The Franchot firm also recently started operation of a larger plant at Kiefer, from which it already has shipped three tank cars of gasoline.

Discovery of new oil production in Trinidad leads Barber Asphalt Paving Co. to start erection of a refinery near its asphalt works at Perth Amboy, N. J. A new line of tank steamers will be put in operation soon to carry the oil.

25 years ago

April 30, 1936

State of Texas reports a net profit of $807,051 from the sale of 3,000,000 bbl. of confiscated, illegally produced oil. Prices paid for the oil ranged from 10 to 95 cents.

Revival of drilling activity in West Texas boosts well completions during the week to the highest level in more than 5½ years. All except 6 of week's 41 completions were wildcats. New locations mount as play spreads.

Continental Oil Co. launches $12,000,000 spending program in Central Kansas with laying of $650,000 8-in. oil pipeline from Geneseo field, in Rice County, to Valley City station, near Wichita, on company's main line to Ponca City. New line, with 4-in. lateral from Mound Ridge field, to have capacity of 14,000 bbl. daily. Extensive development projected in Geneseo and Mound Ridge fields.

10 years ago

May 3, 1951

Phillips Petroleum Co. raises K. S. Adams from presidency post he has held since 1938 to board chairman. Paul Endacott, executive vice president and assistant to the president, is made president.

Iranian Parliament votes immediate takeover and liquidation of properties of Anglo-Iranian Oil Co., Ltd. The company's huge Abadan refinery resumes full operation after limping through 12 days of limited operation.

JOURNALLY SPEAKING

Thank You, Mr. Carroll

THERE WAS something hauntingly reminiscent about it. The proposal of President Kennedy and Dean Landis to appoint seven commissioners to the Federal Power Commission in an effort to clean up the gas-price mess had a familiar ring.

We just couldn't get it out of our head that somewhere, way back in our childhood, we had heard a similar story about seven people trying to clean up an equally impossible mess.

It worried us. A line or two would flit across our memory dimly, but not enough to identify the reference. Finally we enlisted the aid of a sympathetic scholarly gentleman at the public library, and he found it for us.

It was a poem that started out describing the vast quantities of sand piled uselessly upon the seashore. Then came the familiar lines:

The Walrus and the Carpenter
Were walking close at hand:
They wept like anything to see
Such quantities of sand.
"If this were only cleared away,"
They said, "It would be grand."

"If seven maids with seven mops
Swept it for half a year,
Do you suppose," the Walrus said,
"That they could get it clear?"
"I doubt it," said the Carpenter,
And shed a bitter tear.

That was what we were searching for, and we were tickled immensely to see that Lewis Carroll's nonsense rhyme from "Through the Looking Glass" so neatly expressed our own doubt that seven commissioners with seven mops can clear away the derelicts and debris on FPC's beach.

But then we read on in the poem—and nearly dropped our teeth at the aptness of another parallelism, one that we had forgotten completely.

The Landis and the Kennedy plan goes on to request that small gas producers take a walk away from regulation.

The Walrus and the Carpenter plot goes on to request the oysters to take a walk away from the beach. The large oysters declined, but the small ones eagerly went along. After a while they all sat down for a picnic. Then came more familiar lines:

"The time has come," the Walrus said,
"To talk of many things:
Of shoes—and ships—and sealing wax—
Of cabbages—and—kings—
And why the sea is boiling hot—
And whether pigs have wings."

"A loaf of bread," the Walrus said,
"Is what we chiefly need;
Pepper and vinegar besides
Are very good indeed—
Now if you're ready, Oysters dear,
We can begin to feed."

"But not on us!" the Oysters cried,
Turning a little blue.
"After such kindness, that would be
A dismal thing to do!"
"The night is fine," the Walrus said,
"Do you admire the view?

"It was so kind of you to come,
And you are very nice!"
The Carpenter said nothing but
"Cut us another slice.
I wish you were not quite so deaf—
I've had to ask you twice!"

"I weep for you," the Walrus said,
"I deeply sympathize."
With sobs and tears he sorted out
Those of the largest size,
Holding his pocket-handkerchief
Before his streaming eyes.

"O Oysters," said the Carpenter,
"You've had a pleasant run!
Shall we be trotting home again?"
But answer came there none—
And this was scarcely odd, because
They'd eaten every one.

We wonder: Was Lewis Carroll writing a nonsense jingle . . . or a political forecast?

—Henry D. Ralph

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What to do about the slow increase in demand

IT HAS TAKEN a few years to accomplish, but the oil industry is now pretty well conditioned to keeping a close watch on trends in market demand in both current operations and long-range planning.

The realization that demand will grow only slowly during the next year or two has also pretty well soaked in.

But what has not yet thoroughly permeated the industry's thinking is the possibility that demand may not, in the near future, resume its former pell-mell upward push, and that some other factor should be looked to as the basis for long-term profits and prosperity.

OIL IS NOT ALONE in this dilemma. It is significant that at the recent meeting of the Commerce Department's Business Advisory Council the heads of big companies in a broad range of industries agreed that demand for their products is tapering off.

Faced with the prospect of a slow normal growth in demand, these industries without exception are turning to research as the key to better business and to opportunitiees for expansion.

Part of this research, of course, is the familiar type aimed at reducing costs and improving the quality of present products. But much of it is of a type comparatively new to many industries, research directed toward entirely new products or exotic uses for old products—things nobody ever thought of before.

Research to create new demand (a thing quite different from just promoting existing markets) is a concept relatively new to all but a very few of the largest companies in the oil industry.

But the effort is spreading widely. This year's annual reports of company after company disclose increased appropriations for research and development and stress the search for imaginative new outlets for something made from petroleum.

This is in line with the national trend. The National Science Foundation reports that industry's expenditures for R&D have risen sharply since 1958 although capital expenditures dropped 20%.

BUT OIL, PERHAPS, should do more than some other industries in research for new demand. Because there is a lot of research aimed at destroying oil's present markets.

On the horizon are atomic power, fuel cells, thermoelectric units, and other potential new sources of power. Less spectacular but possibly an even bigger threat to demand growth are research projects aimed at increasing the efficiency—and lowering the fuel consumption—of steam-generating, space-heating, and automotive-propulsion units.

The warning here is obvious: It might not be safe to just sit tight and wait for demand to pick up by itself. If you want new demand, go out and create it.

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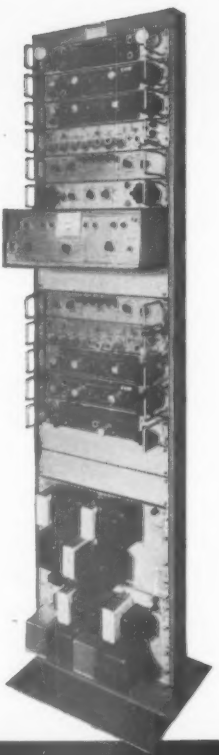

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Tax Proposals Don't Excite Oil Men

• Four-cent federal gasoline tax to finance highway construction now looks pretty certain. But Kennedy's latest tax proposals may not fare so well. This doesn't worry oil men, who see little benefit in them anyway.

TAX PROPOSALS affecting the oil industry directly and indirectly came in for considerable consideration last week.

First there was the reaction—mostly negative — to general tax proposals made to Congress recently by President Kennedy.

Then there was the highway program tax legislation approved last week by the House Ways and Means Committee. It certainly brought no cheer to the industry.

Neither program is final yet. In fact, Kennedy's general tax program is still in the embryo stage as far as Congress is concerned. Much of it is likely to be discarded or greatly revised before it makes its way through the legislative mill.

On the other hand, the highway tax battle is about over. It still must clear a House floor vote and be acted on by the Senate, but there is little indication that it will face any major obstacles.

Highway tax plan . . . There weren't many surprises in the final form of the highway financing plan produced by the House committee.

Basically, it provides for:

. . . A 4-cent-a-gallon tax on gasoline through the remaining 11 years of the highway construction program. Thus, the 1-cent reduction that was to have been made July 1 under the terms of the original legislation has been abandoned.

. . . A 4-cent-a-gallon tax on diesel fuel. This is a continuation, too, of the present tax. But it represents a victory of sorts for the trucking industry because the President had asked for a boost to 7 cents.

. . . A higher tax on rubber, both for new tires and tubes and for retread purposes. The committee has proposed an increase from 8 cents a pound to 10 cents on rubber for new tires and an increase from 3 cents to 5 cents a pound on retread rubber.

The committee also proposed an increase in the highway user tax for buses and trucks, although not as much as the President had recomended.

Finally, the committee would earmark all the 10% excise tax on trucks and buses for the highway trust fund. At present, half goes to the highway fund and half to the general revenue fund.

The tax program proposed by the House Ways and Means Committee would go into effect July 1 and would continue until September 30, 1972—the target date for completion of the present national highway construction program.

General tax plan . . . Various segments of the oil industry have been trying on for size some of the proposals the President made on tax changes generally.

These proposals range from tax credits for expansion projects and new equipment to a crackdown on expense account deductions in tax returns (OGJ, Apr. 24, p. 77).

For the most part, oil people feel that the industry would neither gain much nor lose much if the President's proposals were voted into law.

For individual companies, however, there could be a loss or a gain, depending on the circumstances.

One tax executive for a major oil company declared privately the proposals would not solve any basic financial problems and oil firms generally would benefit less than companies in other lines.

Tax incentives . . . Most industry interest centers on the president's proposals aimed at encouraging plant modernization and expansion.

Kennedy has suggested an outright tax credit, based on a sliding scale, for such expenditures.

A company, or individual, would get 10% credit on the first $5,000 of a new investment, 6% on expenditures amounting to 50% to 100% of depreciation allowances he already receives, and 15% on expenditures exceeding current depreciation allowances.

The limit for these combined tax credits would be a 30% reduction in tax liability in any one year.

Obviously, the small firm would tend to benefit to a greater degree under the tax credit plan than a large company. Thus there would be more likelihood that an independent driller or a jobber might be encouraged to expand his facilities than a major refiner.

For the most part, however, industry observers tend to feel that the president's plan will not stimulate much additional spending by the oil industry.

For one thing, many firms have recently completed major expansion projects and are more concerned now in selling their products than in building new facilities.

One oil executive put his reaction this way:

"Who's going to start a multimillion-dollar project on the basis of the proposed incentive. The Government can give this incentive—and

Licensing of Geologists Urged

PROFESSIONAL registration of geologists, and licensing of those who serve the public, was advocated last week by Ben H. Parker, president of the American Association of Petroleum Geologists.

Parker told the AAPG at its annual meeting in Denver that it must find some way to protect the profession—and the public—from "charlatans, quacks, and self-styled experts" who hang out shingles as "geologists."

The only approach, he believes, is a system of professional registration and licensing.

"Licensing of geologists is a necessity," he said, "and it could be limited to those serving the general public, thus making it unnecessary for those in teaching, research, and similar activities."

Geology is not a pure science, as some contend, Parker said, but a profession based on science. Applied geology is becoming increasingly accepted as a profession, ranking along with law, medicine, and the ministry, he said.

it can take it away—that kind of deal is too uncertain.

"We will continue to make investments only on the basis of their payout. About the only work the proposed incentive will create is the marginal project where a prospective tax benefit would lessen the gamble."

Others object to the tax credit plan on the ground that it constitutes a subsidy, with the accompanying dangers inherent in government subsidy plans.

Many oil-industry people, together with those in other industries, would prefer faster tax depreciation writeoffs to the tax credit approach. This, they point out, is no subsidy but simply gives a firm more flexibility in arranging tax payments and makes depreciation schedules more realistic.

Foreign income . . . For U. S. companies with operations abroad, the President's plan to eliminate tax deferral privileges in "developed" countries has significance.

However, the impact on oil firms probably would be less than on other industries because many oil majors already make a practice of returning annually to the parent U. S. firm profits earned abroad.

What would hit the oil firms a body blow would be the type of legislation proposed by Sen. Albert Gore (D.-Tenn.) which would eliminate credit for taxes paid to a country abroad. This would mean being taxed abroad and at home, too, on the same income.

Expense accounts . . . The President's plan to eliminate outright some expense account deductions—such as maintenance of entertainment yachts—and to tighten up on other expense account deductions has not created much stir in oil circles.

Many firms have already tightened up on such spending in economy moves in recent years. Others would be relieved to have a government reason for slowing down on any such spending.

On the other hand, the prospect of more government snooping into company operations and of having to justify every expense item galls oil-company accountants.

Cooperatives . . . In oil marketing circles, there is favor for the President's proposal to clarify tax law so that all earnings of a cooperative are taxable either to the cooperative itself or to the patrons of the cooperative.

Marketers feel that cooperatives have had an undue competitive advantage in some instances.

The outlook . . . Most of the President's proposals will have slow, tough sledding in Congress.

The tax credit plan as an incentive to plant expansion will certainly draw fire. It very likely will be replaced by some other incentive proposal tied to more rapid tax writeoffs on depreciation.

The proposed tax treatment of foreign income has a better chance of congressional acceptance, and there is a good possibility that the change in taxes on cooperatives will be adopted.

Another proposed change, a withholding tax on interest and dividends, also will get strong consideration in Congress.

All in all, if many of the President's current tax suggestions create controversy, Congress may find it convenient to hold up on the changes to await the major tax-overhaul plan which Kennedy has said will be presented to Congress next year.

New Proposal Made for Alberta System

STILL ANOTHER group has joined the parade of applicants seeking to build a gathering system for transporting surplus Alberta natural-gas liquids to market.

Alberta Gas Products System, Ltd., backed by Canadian Industrial Gas, Ltd., and other principally Canadian interests, proposes a 725-mile 8, 10, and 12-in. system. It would cost $24 million.

Canadian Industrial Gas, formerly Ajax Petroleum, produces natural gas in Alberta and markets natural gas and LPG in the province.

The system would pump south to a connection at the U. S. border with a proposed Continental line, and north to Edmonton to the Interprovincial and Trans Mountain crude-export lines.

This scheme would give the surplus LPG and condensate access to markets in the Pacific Northwest, Rocky Mountains, and Great Lakes.

The line would have a design capacity of 60,000 bbl. daily for the 12-in. on the Edmonton end, and 40,000 bbl. daily for the 8-in. southern section.

Royalite Oil Co., Ltd., also proposes 40 miles of 4-in. line connecting two plants with refineries in Calgary. The plants are Shell Oil Co. at Jumping Pound and the proposed Western Leaseholds Wildcat Hills facility.

Also pending before the Alberta Oil and Gas Conservation Board are five other proposals, competitive at least in part with the new propositions (OGJ, Jan. 30, p. 86).

New Twist Given Underwater Completion

• Standard of Cal and Humble will elevate wellhead 135 ft. off ocean floor, but 90 ft. under water in wells off California. Technique permits use of divers on wellhead platform without exorbitant cost.

A NEW WAY to complete a well under water will be tried for the first time on a lease off California.

Standard Oil Co. of California and Humble Oil & Refining Co. plan to complete two wildcats in Parcel C in the Gaviota area—2½ miles off Santa Barbara County—with the new underwater wellhead arrangement.

The wellhead will be elevated 135 ft. off the ocean floor and set on a cantilevered mast made of 30 and 24-in. pipe. The top of the wellhead will be 90 ft. under water and production will flow to onshore tankage through one of three lines running from the wellhead.

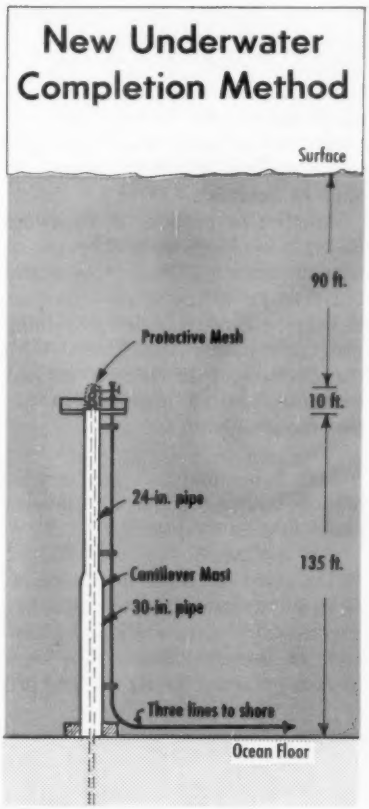
Details of how the well will be completed have not been released, but the technique is believed to be similar to the method developed by Richfield Oil Corp. and Cities Service Co.

The two companies made the first ocean-floor completion last year off Peru (OGJ, Oct. 3, 1960, p. 65). Two ocean-floor completions have been made since then, one by Richfield in Rincon field off California and one by Shell Oil Co. in the West Cameron area off Louisiana (OGJ, Jan. 16, p. 60).

Richfield plans a second ocean-floor completion off California. The company has applied to the Corps of Engineers to complete a wildcat 2 miles off Coal Oil Point on the ocean floor.

The Richfield technique involves a base 8 ft. in diameter and a wellhead structure that raises 11 ft. off the floor. Richfield also uses three lines to shore. Production moves through one, another is used as a control line to operate a hydraulic valve at the wellhead, and the third is an anchor line.

The wellhead is equipped with double seals to protect against leakage and a "fail safe" valve remains closed unless held open by pressure from the ½-in. hydraulic line. Thus if the flow line is cut, pressure in the hydraulic line is relieved, automatically closing the valve.



When the well is ready for completion, the wellhead is installed from the drill ship. The blowout preventers are the last thing removed from the hole. Tubing plugs and the mandrel are run to the top of the hole and the preventers are removed and the wellhead installed after all valves have been plugged.

On the Coal Oil Point well, Richfield plans to use two aluminum lines 2 in. in diameter and one 3-in. line which will be filled with mud or cement as an anchor. The lines on the Socal-Humble wells will be 3½, 2, and 1¼ in. in diameter.

Why important . . . The industry will be watching the Gaviota and Coal Oil Point wells for several reasons.

The water depth is an important factor. The Socal-Humble wells will be drilled in 235 ft. of water and the Richfield well in water 207 ft. deep. To date the deepest completion has been in 55 ft. of water.

Completing wells in water 200 ft. deep would be another step in moving exploration farther offshore. This also would be in deeper water than most offshore drilling barges are now working. However, the three wells planned off California all would be drilled from floating drill ships rather than platforms or barges.

For West Coast operators, the success of the wells off Santa Barbara should also mean other resort areas might open up their tidelands to exploration. Several areas along the California coast prohibit drilling on the grounds that platforms on the surface would harm their beaches.

Apparently divers will be used for the two Gaviota wells, but Richfield has said it can complete wells without divers. It was reported one reason the Gaviota wells are elevated is to permit divers to reach the working platform around the wellhead. The platform will be 100 ft. under water—a depth where divers' rates are not too high.

Economics . . . The underwater completions are expected to be more economical than wells completed from production platforms, but no cost breakdown has been revealed.

One obvious saving would be platform costs. Another would be that less hole would be drilled for the ocean floor wells since they would be straight holes rather than whipstocked holes.

Underwater completions probably will be used widely off California if the proposed wells work out satisfactorily.

They can be used in deep waters out of the reach of permanent platforms or drilling barges and in shallow waters where platforms are prohibited and the pay sands too shallow to slant drill wells from shore.

Marketers Shoot for High-Volume Sales in

W. A. Bachman
Marketing Editor

THE OIL INDUSTRY is in the midst of a service-station building boom nearly without parallel.

Major oil companies and independent marketers alike are busily putting up new stations or buying sites to keep abreast of the nation's growth patterns.

The same companies also are remodeling their older stations that still have profit potential in order to keep a bright company image before the public.

The chief goal along either route is high-volume sales and lower unit costs.

A companion trend to this emphasis on big stations drawing customers from a wide area is often overlooked. It is the closing down by nearly all companies of their marginal stations.

This apparently is not known by civic planners who often oppose the rash of new stations. And the extent of the elimination probably is not known by some people in the oil industry who speak out against station overbuilding.

At least one marketer, P. C. Hawk, market operations manager of American Oil Co., says the industry should publicize this fact to answer its critics.

Hawk points out that American had 27,701 retail outlets at the start of the year compared with 31,216 in 1951. Yet the Indiana Standard subsidiary has pushed a substantial building program during the past decade.

Hawk believes a similar shrinkage holds true for many other companies which now have fewer but larger stations and do a larger volume of business.

Another by-product of the swing to big stations is a shortage of trained personnel. That's why nearly every major oil company this year is bearing down on dealer-training programs harder than ever. With the investment in large stations mounting, good management has become a must.

What's happening . . . The service-station building boom is following some interesting patterns.

For instance:

Locations are near access points to new interstate highways or urban expressways, in new shopping centers, or in new suburbs that show growth potential. Older stations getting face liftings are in settled sections that still have a favorable traffic flow.

Marketers are finding that a state of traffic outside a superstation is not enough. It's more important to be near the destination of that traffic.

One marketing official observes that several years ago any good gasoline retailer could take a traffic count, watch which way the heavy traffic went, and pick a corner site quickly.

But considerable market research is required now to determine the likely spot where heavy traffic can be stopped, where future residential or business growth will occur to provide settled customers who will leave their cars to be serviced, or to decide which station in a built-up area is worth the investment of a costly remodeling job and which should be abandoned.

The extent of this push to nail down good locations is well illustrated by Shell. The company's marketing division last year purchased 800 service-station sites.

Sun also added 391 new stations last year and plans more this year in its 23-state marketing area. Sun marketers say the emphasis is on

Marketers Try New Approaches

"STRIPPED-DOWN" Conoco station in fast-growing Houston is designed to fill the greatest number of gasoline tanks in shortest possible time.

New Stations

acquiring strategic locations for stations in new neighborhoods and in new shopping centers on the edges of towns.

Station concepts . . . Types of stations fall into two major categories: Superstations offering complete sales and service including motor tuneups and minor repairs, and "filling" stations that specialize in motor-fuel sales.

Several majors are experimenting with "image" stations, notably American in Vincennes, Ind., Mattoon, Ill., and Fairfield, Iowa, and Pure in Greensboro, N. C.

In American's case the big station has replaced several smaller outlets in the same town and is doing just as much or more total volume.

Pure's fancy Greensboro station near the downtown area has pepped up sales at company stations all over town and that's what it was primarily designed to do. The station itself has not reached its full potential volume.

At its unusual "circle of service" station in Tulsa, Sunray Mid-Continent is experimenting along several lines. One is the idea that a novel building, plus customer convenience and top service, can attract motorists despite location in a still-undeveloped area. Initial reception has been good, but it's too early for Sunray officials to know the answer.

Many independent marketers and a few of the majors have turned to sleek "speed" stations for the highway market. These specialize in gasoline sales with few if any facilities for washing, greasing, or minor repairs.

Just what type of service station will emerge from today's building is still not clear.

Today's marketing strategy of the majors and larger independents hinges on two things:

. . . Volume sales, aimed at spreading unit costs.

. . . Upgrading sales away from gasoline and lube oil alone into TBA, replacement parts, and minor repair work. This calls for large stations with adequate parking area and space for easy access.

What happens to auto design in the years ahead undoubtedly will alter building needs of service stations.

The lube bay could be the first to go. Sealed-in chassis grease fittings already have made their debut.

Longer intervals between grease jobs and oil changes are being promoted by some auto makers.

Add the variety and size of auto and truck models now appearing on the scene and the difficult problem of service-station designers is apparent.

Extent of boom . . . Oil companies literally are pouring millions into the current building campaign.

- Tidewater, for instance, has spent $81 million since 1955 on new stations and on purchasing sites for future outlets—plus remodeling older stations.
- Ohio Standard spent a record $7.3 million last year on its building program and plans to continue the policy this year. Much of the money went for new sites and to put new stations at locations where the established facility had become obsolete.

Building programs of others:

- American Petrofina will continue building units to company design and acquiring others where possible. It built 46 new stations last year and acquired 319 others, increasing total outlets to 2,003.
- Atlantic Refining reports upgrading is the key to its construction in 1961. The company is replacing service stations which do not serve a public need or which do not offer dealers an adequate income with modern outlets in communities that have a good growth potential.
- Gulf Oil is developing new stations on a modest scale. It is

NEW-LOOK concept is exemplified in DX Sunray's circular facilities" station in Tulsa.

IDEAS for service-station promotion and equipment are sifted in this warehouse lab at Mobil's test-design center in Carlstadt, N. J.

Texaco Keeps Title of "All-States" Marketer

BY OPENING a service station in Honolulu, Texaco Inc. has regained the distinction of being the only marketer in all states of the union.

Temporarily derailed by the admission of Alaska and Hawaii as states, Texaco moved into Alaska 6 months ago and now has more than 10 stations there.

The breakthrough in Hawaii was disclosed last week at the company's annual stockholders' meeting in Houston, where President James W. Foley said both new states have Texaco-brand gasoline for sale at the pump.

A company marketing executive said Texaco does not intend to have only token representation in Hawaii and Alaska.

Fourteen stations are under construction in Hawaii, and a storage terminal has been placed in operation at Barber's Point there.

Foley told the stockholders that marketing competition, both in the U. S. and abroad, is becoming "more and more intense" and that Texaco anticipated this development several years ago by realigning its marketing setup.

"The current competitive struggle is reflected in the efforts of various other oil companies to simplify their organizations and extend their marketing operations to the entire United States," Foley said.

Texaco and its affiliates increased product sales by 3.5% last year over the previous year and expect to make another substantial gain this year.

The company has the largest number of service-station outlets in the country, about 40,000.

centering its efforts on acquiring high-volume, low-cost locations and on eliminating substandard retail outlets or those hurt by highway changes or new urban developments.

• Derby's representative of the smaller refiner-marketer, is concentrating on building more controlled service stations. For 1961, it has a program calling for completion of at least 5 new stations each month. It has adopted as a standard a preassembled, porcelained station building designed for quantity production. The buildings are easily moved to new sites and give maximum efficiency to customers.

• Champlin will continue a program of rebuilding and upgrading its stations after adding 63 new stations last year. A more readable trademark-identification sign also is being put up throughout the company as part of the drive to create a stronger company image.

• Jersey Standard is concentrating on fewer but better locations. President M. J. Rathbone says the campaign thus far has resulted in throughput which is three to four times higher than before.

• Ohio Oil is concentrating its expansion effort in areas of high traffic volume and in rapidly growing suburban communities. Both its Marathon and Speedway 79 sales organizations are pushing service-station building and modernization.

Marathon opened 74 new stations last year and 21 older stations either were replaced or remodeled to conform to the Marathon "showcase" design. Speedway built 33 new stations on new sites and modernized 24 others.

• Phillips is expanding by building new stations in growth areas and by securing new jobbers and dealers. It is sporting new station designs, including winged canopies and drive-through work areas in the back.

• Shell is intensifying development in areas where it already markets. The company also is expanding into western New York, southern New Jersey, and the Texas markets around Fort Worth-Dallas, San Antonio and Austin.

The 800 new Shell sites acquired last year will be used to offset discontinued low volume, substandard outlets, and stations lost through condemnations for highway developments. Early results of the program already show that average sales per outlet have gained 2% over the 1959 figure.

• Skelly had 47 stations under construction or approved for construction at the first of the year after building or modernizing 78 stations last year.

• Sun is beefing up its outlets with emphasis on sites in new neighborhoods and new shopping centers. The new stations are designed to be attractive to their areas with orderly TBA display areas and more efficient wash and lube bays.

• Sunray Mid-Continent has plans to build other new prototype stations this year, following up its circular station in Tulsa. The experimental building, however, is a very small part of Sunray expansion. Last year the company built 65 service stations, remodeled 20 others, and purchased 76.

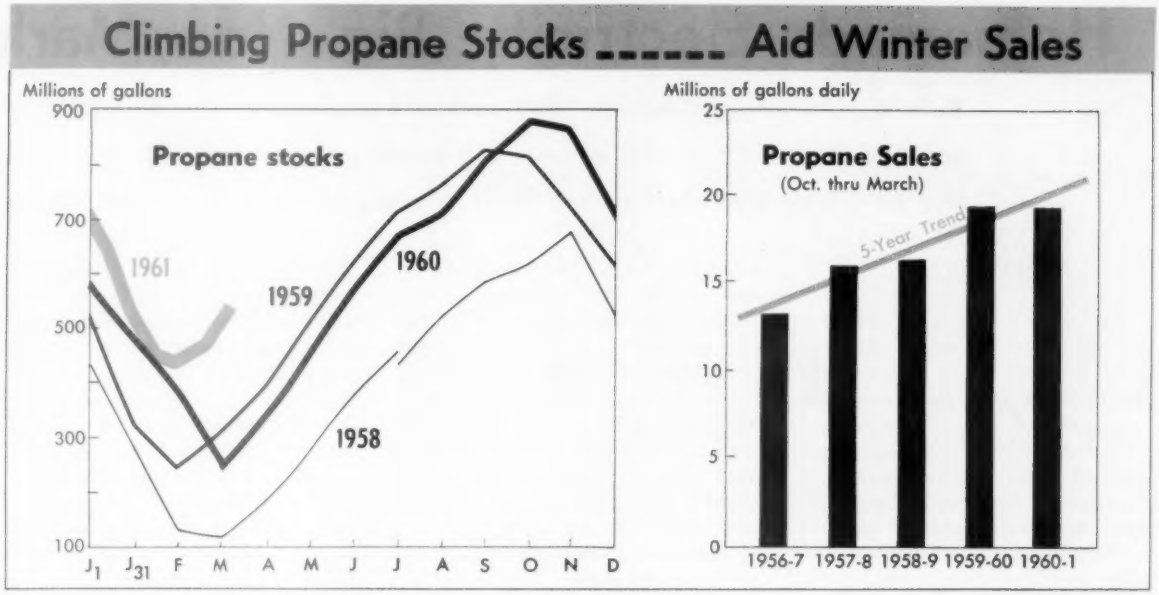
• Texaco is concentrating in the U. S. on the development of fewer but larger and more complete service stations. This is being supplemented by modernizing and enlarging existing stations with good potential. The goal is a greater volume of business at a lower unit cost.

• Union Oil of California is following a similar policy which last year saw the company build 104 new stations, modernize 16, and eliminate 82.

• Sinclair's selective expansion program is being accompanied by a bigger program to shine up the company image. More stations are wearing the brighter and more modern green-and-red colors.

Plans of these larger oil companies, however, merely indicate the national scope of the station-building program. Similar plans are being made by scores of independents and private branders.

Scope of building by the independents can be traced in statistics given by Sun Vice President Willard W. Wright for Sun's marketing area. He said the number of major brand stations increased by only 1% from 1954 to 1960 but number of private-brand stations rose 75%.



Outlook for next winter:

Enough Propane for a New Sales Record

PLANT operators are running propane to storage early this year and by next October should have a record stockpile of product.

If there is any shortage of propane next winter, it will be a matter of location rather than volume. And this fact should be the signal for companies to stage heavier sales campaigns to turn up new markets.

This is the picture:

There was a good stock reduction last December when withdrawals reached 164 million gallons. January was another good month with a stock drop of 175 million gallons.

But the winter demand lasted only through the first half of February. The drawdown in the last half of the month amounted only to 5 million gallons. In March operators started running propane to storage. The accumulation was 28 million gallons in the first half of the month and reached a total of 82 million gallons by April 1.

The result was that total propane inventories reached the all-time seasonal high of 540 million gallons.

Fortunately, these broad swings in propane stocks have been made possible by the rapid expansion of underground storage capacity. The latest API report shows that 76% of all propane on hand at the end of March was stored underground.

The outlook from now to October, however, is for continued build-up of stocks. Summer additions to propane stocks last year totaled 626 million gallons. If operators add that much this year, stocks will top 1.15 billion gallons this fall.

Winter sales patterns for propane show a wide variation. Last winter demand showed little or no gain over the previous year. March was the peak month for the 1959-60 season because of unusually cold weather.

With warmer weather and an unusual spring this year, sales showed a 26% drop from the record set in 1960. The warm weather cut down on the space-heating load, and wet weather in the cotton-growing areas along the Gulf Coast delayed spring plowing and cut LPG-fuel demand.

The big sales months for this season were December and January. These two months accounted for 43% of total winter sales.

Operators already are making plans for the next big season starting about October. These plans call for more production, better transportation, more underground storage capacity, and more customers.

Remote Control of Texas Crude Line Near

SOMETIME next January a Magnolia Pipe Line Co. dispatcher sitting in the Mobil building in Dallas will start punching buttons to control the flow of crude oil throughout the company's big 540-mile, 235,000-bbl.-daily Texas trunk system.

It will be the first known instance in which a major crude carrier has used a transistorized remote-control system, Magnolia officials say.

Dispatchers in Dallas will control crude flow all the way from Magnolia's Midland, Tex., terminal, through its major storage terminal at Corsicana, and on into Mobil's Beaumont refinery. They will be able to check all functions.

L. H. True, company president, said last week that centralizing control of the crude movement in Dallas "will yield substantial savings through reduced operating expenses and more efficient use of the pipeline network."

Homemade Electricity: Big, New Market

• Build your own gas-turbine plant and save big money. That's the pitch of gas men to builders of new schools, big buildings, and shopping centers. It may be a potent weapon in their fight for more of the U. S. energy market.

Robert J. Enright
District Editor

THE NATURAL-GAS industry is launching a daring new offensive in its running battle with electric power for the U. S. energy market.

Armed with new weapons, gas companies are setting out to increase load and profit by taking away—of all things—power-generating market from their electric utility rivals!

The scheme is to sell new schools, office buildings, department stores, and even shopping centers on operating their own utility plants . . . fueled by natural gas.

These buildings would be electrically self-sufficient. They would have no electric-utility connections.

The mere thought of the resulting fruit to the gas industry is putting gleams in the eyes of gas-company executives all over the country.

Gas sales to such a building would multiply 5 or 6 times on the average—and at regular commercial rates. As one gas-company official puts it: "Each installation would add heavily to our income and without increasing our investment one nickel!"

Moreover, substantial sales of this kind would do wonders for the gas company's nagging load-factor problem in the summer months. The privately-owned utility plant would eat up gas at a relatively steady level the year around.

Ideal sales pitch . . . Of course, the owner of a projected new building isn't going to build his own utility plant just because the gas company would make more money.

And the real beauty of the scheme is that it is salable. Gas companies are telling the customer he too, will make money, and lots of it.

By operating his own plant, gas engineers say, the customer would cut his utility costs 25% during a 15-year period in which he was paying off his plant. After that, he would save 35 to 40%, even after paying operating costs.

These figures are generally applicable, gas men say, to the Southwest and Midwest. In areas where cheap electric power is available or where gas prices are higher, savings would be smaller but still substantial, they say.

Savings to the customer on this order should not be hard to sell. Small wonder then, that gas executives are getting enthusiastic.

An official of a southwestern transmission and distributing company calls this development "one of the greatest things ever to hit the gas industry."

Turbine, the key . . . The industry's secret weapon in this campaign for new market is the gas turbine.

The packaged utility plant in a new office building, for instance, would have one or more small turbines driving generators to provide power for lighting, convenience outlets, and other purposes.

Hot exhaust gases from the turbine would be routed to a heat-recovery boiler and converted to low-pressure steam. The steam would be used for space heating, water heating, and by driving absorption-refrigeration units, for space cooling.

This compact package, engineers say, would supply all of a building's utility needs, except water, at a previously unheard of over-all efficiency of around 70%.

Equipment coming fast . . . Gas turbines in the required small-size range from about 500 to 1,500 hp. are just now hitting the market.

Air Research Division of Garrett

FIRST IN THE NATION to use gas turbine in all-purpose utility plant is the Park Plaza shopping center in Little Rock.

for Gas Men?

Corp. and Solar Aircraft Co. are among manufacturers now building and exhibiting turbines of this size.

Gas-company engineers have been working in close touch with these and other manufacturers. And a much wider selection of small turbines will be available soon.

Educating drive begins . . . Gas companies and associations are kicking off a massive drive to educate potential customers on what this development means to them.

Early this year, a Houston architectural engineering firm, Golemon & Rolfe, completed a study showing how the turbine could help cut both construction and operating costs of the modern, new, compact high schools.

Prepared for the American Gas Association and Southern Gas Association, the study last month was wrapped up in a simple, attractive brochure and now is being distributed by the thousands to individual gas companies.

And the gas companies are carrying the message to school administrators and board members, PTA groups, architects, and engineers.

They're showing they can build a compact, air-conditioned school—using gas as the only source of power—for about 16% less than a conventional school of the same size without air conditioning.

And the operating costs of this modern, new school would be 7 to 8% less. The savings would soar to about 16% or more when compared to the same modern school using purchased power, they contend.

Meetings under way . . . Though the school-study brochure has been available to gas distributors for only a few weeks, some already are pushing it hard.

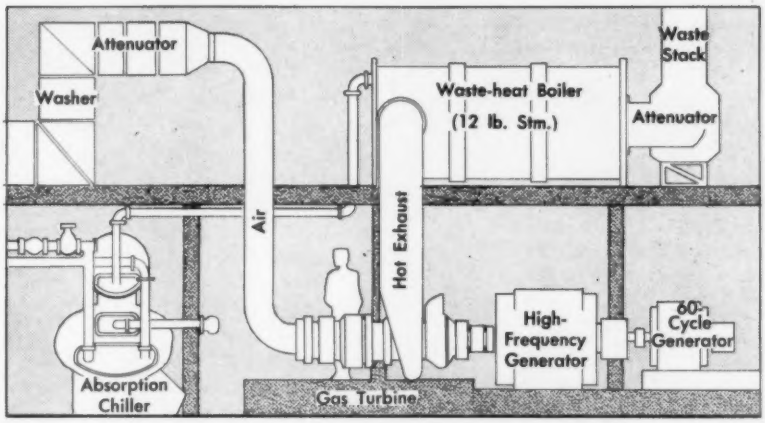
In Texas, for instance, Southern Union Gas Co. held one meeting with school officials, board members, and architects from Port Arthur, Port Neches, and Nederland.

And it has proposals for similar meetings before boards in four other cities, in Texas and New Mexico.

Frank Wright, director of utilization for Southern Union, said the company so far has found school officials keenly interested. But, he says, it takes time. "Right now, this is a missionary proposition. My thought is that 2 years from now we'll be in business."

Many companies not yet started on the new school drive will pitch in during the next couple of months.

Distributor interest generally appears high throughout the country. Companies active on the school front now or planning campaigns include such firms as: United Gas Corp., Lone Star Gas Co., Arkansas-Louisiana Gas Co., Northern Natural Gas Co., Northern Illinois Gas Co., Oklahoma Natural Gas Co., Brooklyn Union Gas Co., and many others.



THIS is a proposed pilot-plant system with a gas turbine driving a generator. Exhaust from turbine is used for air conditioning and heating.

On other fronts . . . At the same time, sales people from some gas companies are chasing prospective builders of new shopping centers, office buildings, and large stores.

Last fall Arkansas-Louisiana Gas Co. sold the owners of a $5,000,000 shopping center in Little Rock on installing exactly the same kind of gas-fueled utility plant now being pushed for new secondary schools.

It is believed to be the nation's first privately owned utility plant powered by the gas turbine.

The turbine is an 1,260-hp. unit. It drives a 900-kw. generator which furnishes 3-phase, 60-cycle, 480-volt power for shopping center lighting and miscellaneous use. Waste heat from the turbine is piped to a 10,000-psi. waste-heat boiler which produces steam for the center's heating system and powers two 250-ton absorption-refrigeration units for summer air conditioning.

Two auxiliary 400-kw. generators driven by conventional gas engines stand by for peak loads and in case of trouble with the main unit. There is also a 10,500-psi. auxiliary boiler for emergencies.

Developers of the Park Plaza center are reported highly pleased with the plant to date and the savings stemming from it. Arkansas-Louisiana has been secretive so far about its sales volume to the center. But informed sources say its gas sales are easily five times what they would be if the center had gone the conventional utility route.

The shopping-center deal wasn't just a lucky accident. Arkansas-Louisiana hired "a smart engineer" and established a new "gas power-generating department" a year ago. The department concentrates entirely on selling the gas-powered private utility plant.

Along with the turbine plant at Little Rock, the company is supplying gas to half-a-dozen plants using conventional gas engines as prime movers.

The turbine, however, compared to the gas engine, is more powerful, more efficient, smaller, quieter, and the air conditioning comes almost as a free bonus.

Arkansas-Louisiana isn't the only company pushing the turbine. Others are hot after new bank and office buildings and shopping centers.

At least two large companies—one in the Southwest and one in the upper Midwest—are planning gas-turbine utility plants for projected new office buildings of their own. They'll make heavy use of cost data gleaned from operation of these

plants in commercial sales campaigns.

Reversing a trend . . . The gas-industry campaign to sell "do-it-yourself" electricity is one gas people will plunge into with great zest.

For they see in it fine prospects of reversing a disturbing trend.

Electric utilities in recent years have been taking away more and more of the gas company's heating revenue by promoting higher-intensity lighting. Lights put out heat.

"Where 1 to 2 watts per square foot used to be considered good lighting, building owners now are installing high-intensity lighting which puts out 6 to 8 watts per square foot," a gas executive told the Journal.

This has reached the point, he said, where some new buildings in the South do not even have space-heating facilities—no gas connections. "They merely turn the lights on at 4 a. m. instead of 6 a. m. to heat the building."

Even where gas is supplied in many new buildings, high-intensity lighting has taken away half or more of the heating load.

Another gas official sums it up this way: "We have lost a lot of our heating load due to lighting. And the only way to get it back is to furnish the power." It's as simple as that.

Gas-company officials expect heavy opposition at the local level from electric utilities.

"But we don't fear it," says William Preston, of Northern Illinois Gas Co., Aurora, Ill. "The power companies haven't hesitated to invade the heating market with high-powered lights and electric space heating. So why should we be bashful about taking away some of their power-generating business?"

Turbine in limelight . . . Concensus of gas-company expectations appears to be that:

The end of this year will see a sprinkling of gas-powered utility plants in operation over the country in schools and various other buildings.

But it will be a couple of years or more before the turbine really begins to catch on.

You'll be hearing more about heating, cooling, and lighting with little gas turbines.

Plasticizer Market Threatened

TWO NEW PRODUCTS may jeopardize the big plasticizer market, which uses large amounts of naphthalene and oxo alcohols.

The chief market for naphthalene is in the manufacture of phthalic anhydride. Almost half of all phthalic production goes into making plasticizers for vinyl plastics and more than half of all oxo-alcohol production is used in vinyl plasticizers.

Now Union Carbide Plastics and Dow Chemical have announced new products which have end-use characteristics like those of flexible vinyls. Neither product contains a plasticizer.

Dow's Zetafin is a copolymer of ethylene and ethyl acrylate. Union Carbide's DPDB-6169 is identified only as an ethylene copolymer, but probably also is an ethylene-acrylate combination.

The companies say their new materials are priced competitively with vinyls and can easily be handled in conventional injection and extrusion equipment.

The unveiling of the new products occurs at a time when new petroleum-naphthalene and oxo plants are coming on stream to help overcome a shortage of plasticizer raw materials.

Sun Nine-Grade Plan Clicks

. . . in Delaware gasoline-marketing tryout. Company may extend the approach as a weapon against private brands.

SUN Oil Co.'s answer to private-brand gasoline competition—a nine-grade gasoline system with competitive prices—has passed initial tests in a big way.

Sun's much-heralded cent-a-grade experiment was begun in New Castle, Del., last October. Since then sales at the station have been 98% higher than sales during the period from October 1959 to April a year ago.

Willard W. Wright, Sun senior vice president, indicates the company is considering broadening the test with several stations in a single area. And product would be sold under the Sun name rather than the cent-a-grade brand used in the first experiment.

The plan calls for opening up all nine stops on the Sun blending pump. Sun first tested its multiblend system with six grades in Florida in 1956 and adopted it throughout its marketing system the next year.

The new grades under consideration include Blue Sunoco 180 and 190. Both would be lower in octane number than Blue Sunoco 200X, presently the lowest of the six grades sold. These two grades would sell for 1 and 2 cents under the price of regular-grade gasoline.

The third new grade would be Blue Sunoco 250, which would complete a range between present grades of Sunoco 240 and 260. The grades will be priced 1 cent apart.

The two lowest grades would meet prices of private brands and would give Sun a further test of the effectiveness of its nine-grade system.

Sun has not revealed the octane number of its various grades. The top octane is believed to be on a par with superpremium third grades now exceeding 100 research octane number, and the lowest on a par with private-brand regular.

Tidewater also has embarked on a similar nine-grade experiment at three stations—one near the Philadelphia international airport, another at New Rochelle, N. Y., and a third at Belmont, Mass. The company plans to conduct the tests for 6 months to a year.

Tidewater's move was preceded by an independent dealer's use of the nine-grade pump. The dealer sold branded Tidewater products at a station close to Sun's Delaware spot.

The importance of Simplicity in a retrievable squeeze packer

Complexity is a retrievable squeeze packer's worst enemy. Simplicity of design is the best guarantee that the packer will do its job well and retrieve.

Simplicity and reliability go together in the Baker Full-Bore Cementer. This rugged tool is trimmed to fighting weight. It sets and packs off easily. It holds pressures from above or below, and does it with a tenacious grip. It retrieves easily.

Here's a tool so good it has changed everybody's ideas on how a squeeze packer should perform. Thousands of successful high pressure cementing, frac, and testing operations demonstrate its success.

THE BAKER SERVICEMEN who run the Full-Bore Cementer have two important things working with them and for you. They have professional skill in running Baker service tools, and in the Full-Bore they have a superior tool to run. The combination offers a dependability that's hard to equal.

BAKER FULL-BORE CEMENTER

Product 410-C

BAKER OIL TOOLS, INC. HOUSTON / LOS ANGELES / NEW YORK

Facts about a reliable squeeze tool

1 It is an important squeeze cementing tool. (Full Bore makes reversing out sand bridges easy; and allows re-perforation, when necessary, without a round trip with tubing.)

2 Ability to hold pressure from above or below makes it ideal for testing casing.

3 Optional Baker Model N Full-Bore Tubing Tester permits testing of tubing string in conjunction with operation of the Cementer.

4 The Cementer is an important tool for formation fracturing and high pressure acidizing. (Full Bore helps prevent sand screen-out when fracturing. On completion of frac or acidizing operation, tubing may be swabbed immediately, without having to reset the Cementer. When pressure reverses, opposite set of slips takes over automatically. Packing elements stay packed off, resist pressure from either direction.)

5 It is teamed with the Baker Retrievable Bridge Plug in straddle operations—either single-zone or selective multiple-zone. Together they can straddle a virtually unlimited interval. And: because both Cementer and Plug are so easy to pick up and relocate, any number of zones can be tested and treated in one round trip.

6 An unloader allows circulation above the Cementer, or equalization of tubing-annulus pressures, when desired.

7 The packer retrieves simply and easily. For added protection, two emergency release mechanisms are built-in.

Automatic Pipeline Welding Sure to Advance

● After long struggle to emerge from laboratory stage, method is proving itself on the right of way. Three manufacturers are bringing out machines.

THIS YEAR will go down in history as marking the arrival of the long-awaited era of automatic field welding of pipelines.

After years of research, field testing, and an untold number of false starts, success has suddenly crowned the efforts of three builders of automatic machines which will join pipe on the right of way. Another may be added to the list before the year is out.

The achievement is reflected in the fact that pipeline welding was for the first time the main attraction at the forty-second annual American Welding Society convention and show in New York.

The three successful automatic machines demonstrated at the show or in nearby plants were:

... The Aircomatic pipeline welder developed by Esso Research & Engineering Co. in cooperation with Air Reduction Sales Co., Battelle Memorial Institute, and Crutcher-Rolfs-Cummings, Inc.

... The Price-Crose-Perrault-Hobart machine developed by H. C. Price Co. in cooperation with Crose-Perrault Equipment Corp. and Hobart Brothers Co.

... The Linde - Bechtel machine developed by Bechtel Corp. and Linde Co.

The first two machines have already been proved in field tests (OGJ, Jan. 30, p. 84, and April 24, p. 70). The third, having performed well before industry audiences, is almost ready for field testing.

All three use a gas-shielded arc-welding process.

A fourth machine is being developed by Lincoln Electric Co., with contractors using a vapor-shielded arc-welding process.

Esso Aircomatic . . . A prototype of these machines underwent a 6-month field trial in building a line for Humble Pipe Line Co., sister company of Esso, in Texas. This was the first mechanized process ever used to weld pipe on the right of way.

The prototype, capable of welding 4, 6, and 8-in. pipe, will next be put to work for Creole Petroleum Corp., another Esso affiliate. It will be used on a pipe-laying barge in Lake Maracaibo, Venezuela.

Airco also has completed a 16-in. version which is undergoing final laboratory tests before field trials in Calgary.

A 30/36-in. machine is being designed. It will be completed for field trials soon.

The machine welds at the rate of 45 in. per minute. It will complete the weld in a single pass on pipe with a wall thickness of up to 0.250-in. This means that the 30/36-in. machine, which must cope with heavier-wall pipe, will be designed for multiple-pass operation.

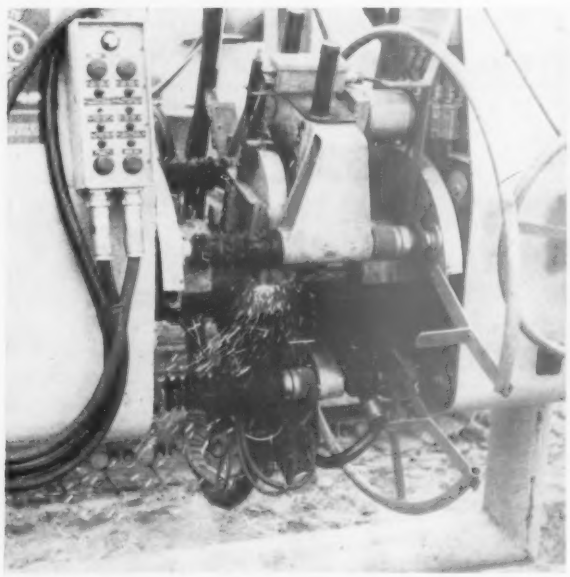
The builders are confident that the machine can speed up pipe laying. And they are certain it can produce welds of higher quality and greater consistency than is possible in manual welding.

The machines may be used singly or in groups, with one leapfrogging the other as manual welders do.

Price - Crose - Perrault - Hobart machine . . . Like the first automatic pipe welder, this uses a CO_2 shielded arc-welding process.

The machine introduced mechanized welding on the right of way of large-diameter pipe. It has been welding 36-in., 0.438-in. wall pipe on an H. C. Price spread on the Alberta-California gas line for nearly 3 weeks.

Price is using the machine in



SPARKS FLY as an Esso-Aircomatic welding machine starts its trip around small-diameter pipe in a demonstration.

AN OPERATOR checks a look-box as an automatic welder developed by H. C. Price makes pass on big-inch pipe.

conjunction with manual welders on the firing line after the stringer bead and hot pass have been run manually. A second machine is being sent to the job to work in the same manner.

The contractor reported remarkable consistency in the welds, with only one reported defective in the first week. Pipe is accepted as welded and no cleaning or grinding is necessary. The procedure meets API codes for bending, X-ray, and other tests.

Builders report the machine has joined 36-in. pipe in less than 8 minutes. This is not a completed weld, of course, and other passes must be made.

The next advance is likely to be the addition of a second arc. That would cut welding time in half.

Linde-Bechtel machine . . . This pipe welder uses a gas shield of 75-25 argon-CO_2 mix rather than 100% CO_2, and is designed as a multiple-pass machine for welding 18 to 36-in. pipe.

It hasn't reached the field yet. But its builders say it passed its laboratory tests "with flying colors" and performed well in demonstrations before pipeliners recently. The field trial is expected in the late spring.

"Our big-inch machine weighs about 700 lb.," Linde says in a brief description, "will be mounted directly on the pipe, and will produce a uniform weld head automatically as it moves around the pipe."

Linde estimates the use of its automatic machine would reduce welding-manpower needs by 50%.

Effect on manual welding . . . Linde's statement on labor reduction is the only definite estimate that any welding expert is willing to make at this time.

All see mechanized welding as a supplement to manual welding. The two procedures are expected to coexist for many years.

Some welding students believe utility welders will never be replaced on a pipeline spread.

Asked to rate automatic field welding with other construction achievements, one veteran pipeliner says without hesitation:

"It's the biggest thing since we changed from screw pipe to welded joints more than 30 years ago."

watching WASHINGTON

Clyde La Motte

• Oil barter plan gets its initial test this week . . .

THERE WILL be more than usual interest in a bid opening in Washington this week. Reason: The military will be making its first test use of the barter plan for obtaining oil supplies from foreign countries.

Under this plan, a company winning a supply contract would be paid in wheat or some other surplus U. S. agricultural product. It would then dispose of this grain abroad through brokers.

On the eve of this bid opening, there was speculation as to how many companies would submit bids, how much commission they would pay the brokers, and what the military would do if it got a non-barter bid at a price substantially below the barter-bid prices.

(It is understood that at least one major company is planning to submit a "non-responsive" bid which would be an offer to supply oil on the usual terms without the involvement of any grain swap.)

Some companies hadn't made a decision late last week whether they would submit a bid at all. They were tempted to give the barter plan a try, particularly since the current military request is for a whopping 6,200,000 bbl. of Navy Special, but there are some aspects to the plan they don't like.

For instance, there is no guarantee that the Navy will pick up all of the purchase. If not, the seller will be stuck for the commission he pays to the barter agent because that commission is based on the total sale—not just the portion picked up by the military.

Other angles have some firms perturbed. But the government's Commodity Credit Corporation says it normally encounters such objections when a new barter plan is being worked out.

• Can gas industry segments get together on a bill?

WATCH FOR a new effort to pump life into a drive to get some form of natural-gas-regulation legislation the industry could live with.

There has been a recent flurry of meetings between interested industry representatives and congressmen who are concerned with such legislation.

Whether the various segments can find a satisfactory common ground remains to be seen, but a fresh push is being given.

Any step in that direction will have to be taken fairly soon because congressional committee hearings on the issue, including the President's proposed exemption of small producers, probably will be launched in the weeks ahead.

A stalemate is not at all unlikely, meaning that the pileup of producer cases at the Federal Power Commission would continue indefinitely.

• Opinions on Udall are beginning to take shape now . . .

INTERIOR Secretary Stewart L. Udall is undergoing closer scrutiny at this stage of the new administration than any other cabinet member.

The apparent reason is that he has barged into several controversial issues with his opinions flying.

At this point, judgment on Udall varies. Some feel he is showing striking resemblance to a bull in a china shop. Others applaud his boldness and his evident determination to close in on problems instead of waiting for them to close in on him.

Canadian Crude Hopes Brightened by Exports

TWO NEW U. S. customers for Canadian crude oil will start taking deliveries in May.

Canadian crude will enter the Buffalo, N. Y., market—long considered a natural outlet—for the first time. Ashland Oil & Refining Co. will take 8,000 bbl. daily from Alberta for its Buffalo refinery.

Pure Oil Co. will begin receiving 1,400 bbl. daily of Midale crude from Saskatchewan for its Toledo refinery. Alberta crude moved into the Detroit-Toledo market late last year, going to refineries of Gulf Oil Corp., Standard Oil Co. (Ohio), and Mobil Oil Co.

Pure describes its May purchase as "being spot without setting any pattern for the future."

Increasing exports . . . These two developments—especially the opening of the Buffalo market—will improve Canada's already-good prospects for substantially increasing crude production this year.

Exports to the U. S. Midwest for the first 6 months are estimated at 83,000 bbl. daily, 21,000 bbl. daily above 1960.

Canada is still expected to fall short of the national-oil-policy goals of 625,000 bbl. daily production at mid-year, and 640,000 bbl. daily for all of 1961 (OGJ, March 27, p. 74).

But the export expansion is evidence of the progress being made by Canadian producers—especially those who import foreign oil into Canada—under prodding by Trade Minister George Hees.

The alternative, as threatened by Hees, is imports controls in Canada and construction of the proposed Edmonton-Montreal crude line. This would displace foreign crude refined in Montreal with supplies from western Canada (OGJ, Feb. 6, p. 88).

Despite failure to meet the Canadian Government goals — the first half will be about 25,000 to 30,000 bbl. daily short—the increase is expected to be enough to prevent controls.

The success of Canadians in expanding their export market in the Great Lakes area has not gone unnoticed in Washington. Interior Secretary Stewart L. Udall has said he is concerned about the situation and is looking into it.

Buffalo market . . . For some time, Ashland has been considering Alberta as a source for a portion of its supplies at the expense of the southwestern part of the U. S.

Mobil Oil Co., also has been studying the idea of using Canadian crude at its Buffalo refinery. It is considered a prospective customer.

Ashland has two principal reasons for buying Alberta crude.

The crude has a price advantage over crude from the U. S. Mid-Continent, even after the import tariff is paid. This is a strong incentive because Buffalo is a high-cost raw-material area which must compete with products refined from imported crude on the East Coast.

Also, Ashland can't be selective in the crudes it receives through existing pipeline facilities. It takes a run of stream mixture which varies from time to time.

This mix, Ashland says, is less desirable than Alberta crude for its petrochemical production.

For the time being, Ashland will tanker the crude from the Bay City, Mich., terminal of Interprovincial Pipe Line. (Pure's shipments will be barged from the Superior, Wis., terminal of Interprovincial.)

Later, especially if volume builds and Mobil also starts Alberta purchases, Interprovincial is expected to be extended from Toronto to Buffalo.

INDUSTRY BRIEFS . . .

Phillips Petroleum is looking for onshore drilling prospects in California. So far the company's operations in the state have been limited to two offshore tracts. Its first onshore well may be drilled on a 2,300-acre block 4 miles northwest of North Tejon field in Kern County. Phillips is negotiating with Standard of California for 45% interest in the acreage.

Canadian natural-gas sales should reach 3 billion cubic feet daily by 1965, in the view of E. D. Loughney, president of British American Oil. He told the company's annual meeting that this amount of gas would have heat energy equal to 530,000 bbl. daily of crude oil, almost exactly the Canadian production of crude oil and natural-gas liquids during 1960. Last year's natural-gas sales had a crude-oil equivalent of 200,000 bbl. daily, Loughney said.

A new venture has been formed by South Penn Oil Co., Oil City, Pa., and Zapata Petroleum Corp., Midland, Tex., to develop gas production in Canada and to buy producing properties in the southwestern and Mid-Continent areas of the United States. Special emphasis will be placed on acquisition and development of water-flood and other secondary-recovery projects.

New name of Franklin Oil & Gas Co., Bedford, Ohio, is Franklin Oil Corp. In announcing the change, officials said new name is more appropriate for the 58-year-old company's current operations which include development, processing, and sales of a varied line of oils, greases, and chemicals.

Closing of Superior Oil's division office in Oklahoma City and its exploration office in Wichita Falls, Tex., is in the works. A company official says central division operations in Oklahoma City will be merged into the Mid-Continent division office in Houston, and the Tyler, Tex., exploration office will be expanded to handle similar work currently handled out of Wichita Falls and Oklahoma City.

Louisiana's May-June allowable has been set at 1,034,222 bbl. The figure is 18,691 bbl. daily above the March-April allowable. This increase was granted to take care of new production.

Once Only the U.S. Cavalry and Indians Crossed Terrain Like This

Now the sounds of galloping horses and bugle-calls have faded into history. Only lizards scurry among the dusty rocks, and a glass of cold water may be as much as 50 miles away. But pipeliners can cross it, although they want to complete the job without delays and extra expense.

More and more companies are learning that *high-yield strength, lightwall steel line pipe* from Stupp Corporation speeds up jobs in such "hardship country" and saves money.

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Kline Favors a New, Specific Gas Law

• There's no chance that Congress will exempt all producers from regulation, he says, so what is needed is authority for the FPC to set area prices and a method for determining gas producers' costs.

VETERAN FPC member Arthur Kline thinks Congress should enact a new gas law which would:

...Authorize FPC to fix area prices for natural gas.

...Set out clearly how FPC should determine producer costs.

Such a law is the only realistic way out of the incredible mess created by federal regulation, he told a 2-day symposium on gas technology last week in Tyler, Tex. The meeting was sponsored by the East Texas and Louisiana-Arkansas sections of the Society of Petroleum Engineers of AIME.

This new approach to gas legislation, he said, would avoid "years and years of hearings and court action" and help bring order out of chaos.

Area pricing appears to be the only practical way open to FPC to break the producer rate jam, Kline said. "But, under present conditions, this is a very slow process. It is going to take years to conclude area hearings. And then our decisions will inevitably be taken to court.

"The courts, in absence of a specific law, might well rule out area pricing. Then we would be right back where we started—stuck with fixing individual producer prices."

No hope for freedom . . . Kline threw cold water on producer hopes for a bill exempting them from federal price regulation. "There is no chance that Congress will do this," he said.

"Prospects for passage of even the Harris-O'Hara bill are very dim. This bill would free producers from providing any cost data whatever. And FPC must have some cost information if it is to set prices intelligently."

Kline would have Congress define the cost question in his proposed bill. The bill, he said, should set up ground rules as to how FPC is to determine costs. And it should confine this cost data solely to gas.

Arthur Kline

"It should state clearly that the cost of liquids produced with gas are not the business of FPC."

Furthermore, he said, Congress should say in the bill whether the fixed area price is the absolute upper limit or whether a producer may get more than the area price where his costs justify.

Landis plan . . . Kline said he couldn't agree with President Kennedy and James M. Landis, the President's chief advisor on regulatory matters, that exempting the small gas producer is the right approach to breaking the producer rate jam.

He said he generally favored the President's other proposals for gas legislation, including an enlargement of FPC membership from the present five to seven. But it was obvious that Kline feels these won't ease FPC's basic gas problems.

Kline disagreed with another speaker, Allan Shivers, former Texas governor and now board chairman of Western Pipe Line, Inc., Austin, Tex., that President Kennedy's FPC-enlargement proposal is an effort to "pack" the agency in the "same manner that Franklin D. Roosevelt tried to pack the Supreme Court."

Kline contended that the President doesn't need to enlarge FPC if this were his motive. He pointed out that Kennedy has filled two vacancies and can appoint a third member when Kline's term expires in June—giving the new administration a majority.

Cost-of-service . . . Experience has taught him, Kline said, that cost-of-service regulation, the conventional method of utility regulation, simply cannot be applied to gas production.

The veteran commissioner frankly admitted he had made a mistake in ruling with the commission majority early in his FPC career to use cost-of-service.

He pointed out Oklahoma's West Edmond field as a good example of the complete breakdown of the cost-of-service technique when applied to gas production.

West Edmond, he said, has more

PIPELINE

A replacement program involving 24.6 miles of pipeline is scheduled by Ohio Fuel Gas Co. Projects include 5.7 miles in Medina and Lorain counties, 4.5 miles near Zanesville, and 8.4 miles in Holmes, Tuscarawas, Carrol, and Stark counties, all 12¾-in. lines; 1 mile of 8⅝-in. line in Guernsey County; 2.5 miles of 20-in. line in Madison County; and 2.5 miles of 18-in. line in Meigs, Athens, and Hocking counties.

Transcontinental Gas Pipe Line and United Natural Gas Co. will jointly develop 250,000 M.c.f. of storage capacity in northern Pennsylvania's Wharton gas field. Application for the project will be filed with FPC soon and construction is expected to be completed in 1963.

than 130 operators producing about 750 wells. "Drilling costs are quite uniform over the field. But gas reserves and daily production per well vary greatly due to a steady thinning of the pay zone from one end of the field to the other."

Using cost-of-service, FPC would have to fix a different price for every producer in the field, he said. This would amount to "130 different prices for gas from the same zone in the same field."

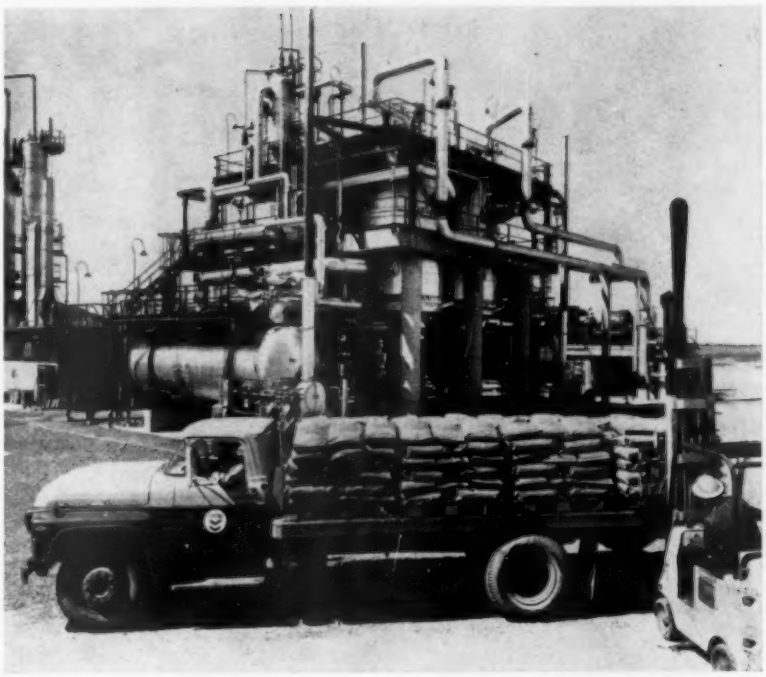
New Four-Company Group Makes High Offshore Lease Bid

A NEW four-company combine to operate in the California tidelands is in the making.

The group is the apparent high bidder for a 4,250-acre tract off Santa Barbara County, California. If the bid is approved, it would not only give California a new offshore operating group, but would also give three of the companies their first drilling activity off California.

The group includes Richfield Oil Corp., Ohio Oil Co., Mobil Oil Co., and Tidewater Oil Co.

The group bid $1,355,111 for the parcel. The only other bid submitted was a $425,000 bonus offered by Texaco Inc.



Petrochem Plant Makes First Delivery

THE FIRST shipment of maleic anhydride has left California Chemical Co.'s new plant at Richmond.

A 30,000-lb. order was trucked to a customer in the West.

The plant also is moving product by rail to customers in the eastern part of the country.

The 20-million-pound maleic anhydride plant operates from benzene supplied by Standard Oil Co. of California's Richmond refinery. The Oronite Division of California Chemical is one of Standard of California's petrochemical subsidiaries.

Badger Manufacturing Co. built the plant.

BRIEFS . . .

Bremerton, Wash., will be served by a 61.3-mile, 10¾-in. lateral if El Paso's construction application to FPC is approved. Natural Gas Transmission Co., an El Paso subsidiary, would extend the lateral 75 miles to Port Angeles. The first portion would cost $2.3 million and the second, $5.3 million.

A total of 1,100 miles of 2 to 10-in. line will be laid for Northern Natural Gas this summer by six contractors. The contractors and projects: R. H. Fulton, 428 miles in Iowa; Brodie Construction, 176 miles in Iowa and Nebraska; Harbert Construction, 138 miles in Minnesota; Shamrock Constructors, 130 miles in Iowa and Nebraska; Davis Construction, 116 miles in Minnesota; and R. E. Reutzel, 116 miles in Minnesota and South Dakota.

A multiplexing - communication system will be used by Pacific Gas & Electric and Pacific Gas Transmission on the U. S. portion of the Alberta-San Francisco pipeline. The equipment, sold by Lynch Communications, is a fully transistorized, high-density system. Provisions will be made for dropout and reinsertion of up to 12 channels of communication at intermediate stations.

Fifty miles of 18-in. line, part of the Portland Pipe Line system from Portland, Me., to Montreal, will be taken up, repaired, and relaid. The work will be handled by Oklahoma Pipe Line Constructors.

Four construction projects are planned by Trunkline Gas Co. for completion this year: A 21.4-mile 30-in. line from Vienna to Marion, Ill., a 21-mile 30-in. line from Dry Creek to Pitkin, La., a 76-mile 26-in. line from Longville to Cow Island, La., and a 52.2-mile 20-in. line from Bayou Sale to Cow Island.

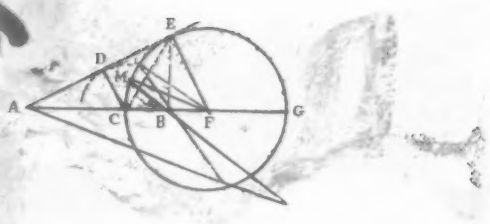
About 45 miles of distribution lines and 40 miles of service lines will be laid in Anchorage, Alaska, by Anchorage Natural Gas this summer. Gas will come from the Kenai Peninsula through a line which has been completed except for crossing of Turnagain Arm.

Crude line from Fiddler Creek to Newcastle, Wyo., will be constructed by Belle Fourche Pipeline Co. The line will be 6-in. Plains Pipeline Division of Franklin County Coal has withdrawn its plans to lay 70-mile line from Fiddler Creek to Lance Creek field.

THE QUALITY OF THINKING

The mind of Galileo—keenly analytical, superbly trained—led him to founding the science of experimental physics, which, centuries later, is revealing the mysteries of space. It is self-evident by his achievements that Galileo's mind reached a level of quality far above ordinary standards of excellence.

Within the same area of meaning, the quality of minds responsible for an engineering project can be evaluated only by results. When you check the record of Brown & Root's engineering through the years, the high quality of thinking reveals itself. Customer satisfaction from greater efficiency at lower costs has built a worldwide reputation for engineering and construction by Brown & Root.



"The knowledge of a single fact through a discovery of its causes prepares the mind to understand and ascertain other facts..."
Galileo

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Louisiana Sale Marked by Lukewarm Bidding

• Most offshore tracts, which had been leased before, went begging. Biggest per acre price in Bay Marchand.

LOUISIANA'S first lease sale of the year was no bonanza, but it had its moments and netted nearly $16 million for the state.

As expected, the big interest was in the offshore tracts—although most of these went begging and competition was lax.

Actually the biggest per-acre price—$1,608—in the April 20 sale went for an onshore marshy tract north of the Bay Marchand area.

All of the offshore tracts were in the state-owned Zone 1. Most had been leased before and dropped.

The sale brought in a total of $15,993,000, of which $10,265,000 went for 16 offshore tracts stretching from West Cameron to Main Pass. Average offshore price was $272.48 per acre.

The Atchafalaya Bay area had the most expensive offshore tracts—and Humble Oil & Refining Co. was writing the checks. Humble paid $2,657,575 for 3,450 acres in one tract, far above Pan American Petroleum Corp.'s second-place bid of $351,037. The per-acre figure of $770.30 was the largest in the sale for offshore tracts.

Humble shelled out $2,220,500 for a second Atchafalaya tract of 3,050 acres immediately east of the higher-priced tract. Several producing fields are in the area (OGJ, April 10, p. 79).

Strangely, Humble did not bid on two other tracts immediately to the north. There were no bids on one of the tracts. A $90,562 bid by Pan American on the other tract was rejected by the State Mineral Board, which conducted the sale.

Humble's $4,878,075 for the Atchafalaya tracts was tops for one company in the sale of offshore leases.

Pan American, which also got two tracts, paid a total of $1,918,350.

California Oil Co. was third with $1,293,000 for four tracts, and Union of California was fourth with $1,218,627 for five tracts.

Two tracts went to John F. Bricker for $553,000 and one tract to Lyda Hunt et al. (Hunt trust) for $511,111.

The Hunt tract, covering the northwest half of Block 24, Grand Isle area, is just east of a tight hole Hunt is drilling. No one competed with Hunt in the bidding.

Besides Humble's two big buys, only one other offshore tract went for more than $1 million. Pan American paid $1,290,963 for Block 8, West Cameron area. Block 7, immediately to the east, had no bidders, but Block 6, to the east of 7, drew a $736,000 bid from Calco.

The biggest price for an onshore lease was $2,605,818. This was paid for a 1,620-acre marsh tract near the Philo Brice Islands by Texaco Inc., and Louisiana Land & Exploration Co., and set the sale's record average of $1,608 per acre.

The tract, lying in Lafourche and Terrebonne parishes north of the Bay Marchand area, has both production and dry holes on all sides. Most drilling is 14,000 ft. and deeper.

Of the 42 tracts offered offshore, only 17 attracted bids and one of these was rejected.

It is not unusual for companies to nominate tracts on which they do not intend to bid. In this way they keep the competition guessing about which tracts they really want.

Among the tracts shunned were six in White Lake, north of the Vermilion area. A seventh tract went for $27,094 to Union of California.

Only two of seven tracts offered in the Breton Sound area had bidders.

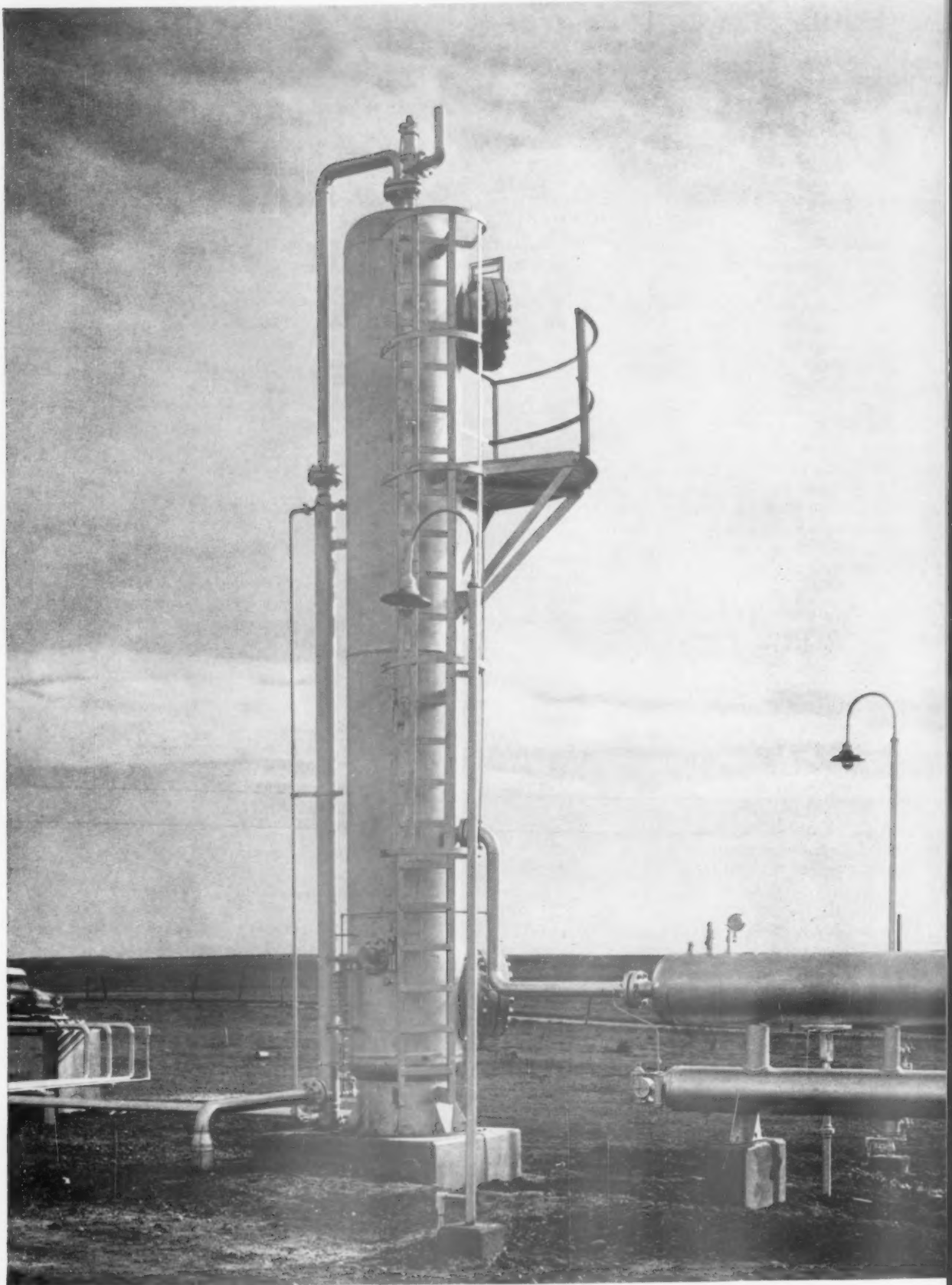
Six tracts never leased before in the Main Pass area were included in the sale, and three got bids. Although there is no nearby production, Union of California paid $526,230 for one and $441,192 for another.

The sale was notable for the absence from the offshore bidding of some of Louisiana's biggest operators—Shell, Mobil, Texaco, Gulf, and the CATC group.

Who got offshore tracts in lease sale

Tract	Location	Company	Bid	Acres
		WEST CAMERON AREA		
7938	Portion Blk. 9	California Oil Co.	$ 205,000	*1,000
7939	Block 8	Pan American	$1,290,963	4,467
7981	Block 6	California Oil Co.	$ 736,000	3,528
7942	Block 5	California Oil Co.	$ 164,000	4,500
		VERMILION AREA		
7948	Block 5	John F. Bricker	$ 151,000	2,227
7949	Portion, Blk. 16	John F. Bricker	$ 402,000	4,030
		ATCHAFALAYA BAY		
7954	(†)	Pan American	$ 627,387	2,650
7955	(†)	Humble	$2,657,575	3,450
7957	(†)	Humble	$2,220,500	3,050
		SOUTH TIMBALIER AREA		
7961	Block 7	California Oil Co.	$ 81,000	3,107
		GRAND ISLE AREA		
7963	Portion, Blk. 24	Lyda Hunt et al.	$ 511,111	2,365
		BRETON SOUND AREA		
7965	Portion, Blk. 52	Union of Calif.	$ 126,000	‡2,292
7967	Portion, Blk. 53	Union of Calif.	$ 95,700	1,740
		MAIN PASS AREA		
7972	Portion, Blk. 6	Union of Calif.	$ 526,320	§2,448
7973	Portion, Blk. 91	Union of Calif.	$ 29,415	¶265
7974	Portion, Blk. 7	Union of Calif.	$ 441,192	2,372

*4,291 acres offered, 1,000 acres bid. †Atchafalaya Bay tracts are north of Eugene Island area. ‡4,789 acres offered, 2,292 acres bid. §4,918 acres offered, 2,448 acres bid. ¶1,406 acres offered, 265 acres bid.



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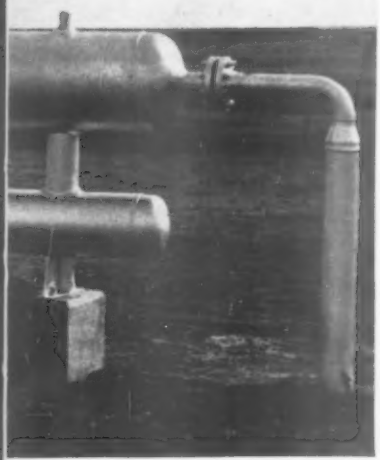


THE DOW CHEMICAL COMPANY DOW Midland, Michigan

Transmission Giants Find Sidelines Pay Off

• Major pipeline companies are getting hefty precentages of their revenues from non-gas operations like refining and marketing of petroleum products.

INCOME from diversified activities is assuming an important role in the financial picture of the major gas-transmission firms.

They aren't depending on the expected growth of natural-gas sales alone to provide revenue. Expansion into petroleum refining, natural-gas processing, and even retail marketing of petroleum products forms a common pattern.

The impact of this trend is seen in the total operating revenue of the transmission giants and the percentage provided by non-gas activities.

Tennessee Gas Transmission Co., for example, in 1960 had $194,415,000 in revenue from sale of crude, petroleum liquids, refined products, and other sources. This represents 33.25% of total operating revenues of $554,707,000.

El Paso Natural Gas had non-gas revenues in 1960 of $117,082,000, or 23.20% of its total operating revenues of $504,634,000. Texas Eastern's outside income was $39,913,000, or 12.61% of its total revenue of $316,524,000. Panhandle Eastern's outside revenue was $4,446,000, or 3.18% of total revenue of $139,994,000.

Nearly all showed a good gain in earnings for 1960. TGT was still the top money-maker with net income of $61,589,000. El Paso Natural was second with $50,909,000.

El Paso Natural had the top income from gas sales, $387,552,000, compared with $346,102,000 for TGT; but TGT's non-gas revenues sent its gross income $50,000,000 ahead of El Paso Natural.

Only Panhandle Eastern showed a dip in profits. The causes: An increase in the field cost of its gas and a lag in rate increases to its customers.

Income Patterns of Four Companies

	Thousands of dollars			
	Tennessee Gas	El Paso Natural	Texas Eastern	Panhandle Eastern
Net income				
1960	61,589	50,909	25,418	20,981
1959	52,366	36,929	19,737	22,905
Total revenue	554,707	504,634	316,524	139,994
Gas sales	346,102	387,552	265,640	135,548
Transmission	14,189		10,971	
Petroleum liquids, products, other	194,415	117,082	39,913	4,446

Management shift . . . Tennessee Gas started 1961 by regrouping its diversified business interests for a sharper division between its regulated gas and its non-utility type interests.

TGT Chairman Gardiner Symonds said this was done to meet a trend toward wider and more intensive federal regulation.

Under the new alignment, the parent firm and the regulated pipelines comprise one group which includes the Tennessee Gas Pipeline Co. division and two subsidiaries, Midwestern Gas Transmission Co. and East Tennessee Natural Gas Co.

A second group is headed by a new subsidiary, Tenneco Corp. It owns all of the producing, refining, and marketing properties, natural-gas production and processing facilities, and other subsidiaries engaged in petrochemical, life insurance, and real estate activities.

During 1960, TGT brought production and refining into near balance at about 50,000 bbl. daily, and 70,000 bbl. daily of refined products were marketed. Reserves of oil and other liquids increased by 45% to a new high of 204 million barrels, while gas reserves were doubled.

In petrochemicals, TGT and Cary Chemicals, Inc., plan a new petrochemical plant on the Houston ship channel; and a 50% owned affiliate, Petro-Tex Chemical Corp., is building new product facilities and plans another addition soon.

Tennessee Life Insurance Co. increased its life insurance in force by 39% to $222 million.

The giant company, however, didn't stand still in the gas business. Gas deliveries increased 20%. A subsidiary, Midwestern Gas Transmission Co., put into operation a 551-mile Minnesota-Wisconsin pipeline; and TGT became one of the three sponsors for a proposed 1,600-mile, $225-million gas pipeline from South Texas across northern Mexico into southern California.

New image . . . El Paso Natural Gas also took on more of the appearance of an integrated oil company during the year.

A subsidiary, El Paso Natural Gas Products Co., which conducts business in production, refining, marketing, and petrochemicals, made a larger contribution to consolidated net income. The products company in 1960 showed a net of $5,897,677 compared with $1,970,651 in 1959.

El Paso operated its 13,000-bbl.-daily Odessa refinery at full capacity during 1960 and the Ciniza refinery of 9,000 bbl. daily at 84% of capacity. It plans to expand the Odessa plant this year with a 900-bbl.-daily benzene unit.

Other plans include expansion of the nearby styrene plant and a joint venture with Rexall Drug & Chemical Co. in an ethylene plant.

The marketing division of the products company introduced multigrade gasoline blending at the pump, acquired 103 new service stations and plans to build 80 new outlets this year. Aim: Greater penetration of the retail market in West Texas, New Mexico, Arizona, southern Colorado, and southern Utah.

The products company also continued oil and gas exploration and

development both in this country and in Canada. At year's end it owned interests in 502 oil wells and 25 gas wells.

It also had 202,768 new acres under lease in the U. S. and 372,935 in Canada. Gas reserves during the year were increased by 5.1 trillion cubic feet.

The gas system was expanded with 323 miles of main and branch transmission lines, 591 miles of gathering and field lines, and two compressor stations.

New emphasis . . . Texas Eastern, meanwhile, is making progress in diversifying its activities in the field of pipelining energy.

Chairman George R. Brown and President Orville S. Carpenter report that in addition to natural gas and petroleum products pipelining, Texas Eastern is pursuing projects involving liquefaction of natural gas and pipelining of coal.

Expansions in Texas Eastern's natural-gas pipeline system during 1960 resulted in a 3% increase in gas sales. Further expansion is planned this year.

Shipments of petroleum products through the Little Big Inch showed a 19% increase. Revenues from this operation increased to $11.1 million from $9.4 million the year before.

Increases in future traffic also are expected from a new interconnection in Ohio with Buckeye Pipe Line Co. and new terminal, storage and delivery facilities.

Panhandle Eastern has launched a modest diversification program which should bear fruit. It engages in oil and gas exploration and production through its own production division and through a subsidiary, Anadarko Production Co.

Panhandle Eastern also owns 1,500,000 common shares of National Distillers, which recently acquired Bridgeport Brass Co. and Federal Chemical Co.

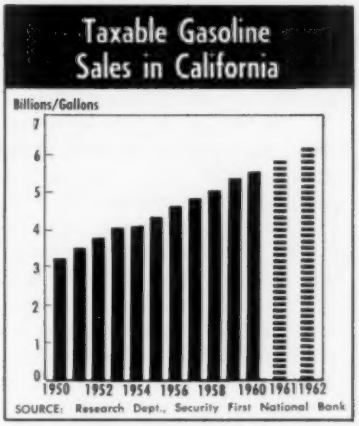
Here's Why Marketers Go West

THE REASONS why so many oil companies want to expand their California marketing operations are obvious when you look at a gasoline sales study made by Security First National Bank, Los Angeles.

The bank says taxable gasoline sales per station in California have increased 3.7% a year for the last decade. Each station is selling an average of 23,500 gal. a month and this is expected to hit 25,000 gal. a month in 1962.

The "most conservative predictions" expect California's taxable gasoline sales for fiscal 1961 to reach 5.907 billion gallons and go to 6.152 billion in 1962. These figures compare to the American Petroleum Institute's report of total sales in the state of 6.012 billion in 1960 (OGJ, Apr. 17, p. 83).

Security First says the number of cars and trucks on California roads is increasing at the rate of 6% a year, but the gallons used per vehicle is declining due to compacts. However, yearly gallonage per vehicle remains at a healthy 710 gal.



The Los Angeles metropolitan area, the world's biggest gasoline market, represents 40% of California's gasoline sales, 38% of the state's service stations, and 43% of vehicle registration.

PROCESSING BRIEFS . . .

Oxo-alcohol facilities with a capacity of 60 million pounds per year will be built by Tidewater and Air Products next to Tidewater's Delaware City refinery.

Aromatics extraction unit with 26 million gallons per year capacity of benzene, toluene and xylenes will be built by Pure Oil at its Lemont, Ill. refinery. Completion is planned in November 1961.

Natural-gas processing facilities with a capacity of 30,000 M.c.f.d. will be constructed at Hennessey, Oklahoma by Continental Oil. Liquid production will consist of propane, butane, and natural gasoline. Completion of the plant and 55 miles of gathering lines is expected this fall.

Oxo-alcohol capacity will be increased from 90 to 120 million pounds per year at Humble's Baton Rouge plant. This expansion will provide for the production of 15 million pounds of 2-ethyl hexanol annually.

A new liquid-propane process unit and a replacement filter plant are under construction at the St. Marys, W. Va. refinery of Quaker State Oil Refining. Completion of the filter plant is expected by July and the propane unit should be on stream by 1962.

Refrigerated-absorption oil facilities for processing 60,000 M.c.f. of natural gas daily will be built by Atlantic Refining Co. near George West in Live Oak County, Texas. Daily liquids production will consist of 32,000 gal. of propane, 17,500 gal. of butane, 7,600 gal. of natural gasoline, and high-purity ethane. O. L. Olsen Co., Inc. has been awarded the contract for the $1.5 million plant.

Expected gasoline consumption of 4.5 million barrels daily in 1961's second quarter will exceed the same 1960 quarter by 1.9%, a Du Pont study reports.

Rising Brownsville Imports Curtailed

A PRELIMINARY agreement has been reached to permit importation of not more than 30,000 bbl. daily of exempt oil from Mexico through Brownsville.

This was decided last week in a meeting between U. S. and Mexican Government oil officials. Details were to be completed later.

The 30,000 figure apparently stems from the fact that this was the level of sales of residual fuel oil Pemex was making to Texaco Inc. until March of last year when Texaco ended the contract because it had developed its own supply of the fuel elsewhere.

Mexican officials sought other U. S. markets to replace the sales to Texaco but ran into the problem of finding U. S. buyers with import quotas.

To meet this situation, the so-called Brownsville plan was worked out last fall. Under it, the oil was to be shipped by tanker to Brownsville and taken under bond across the border. Then it was to be trucked back into the U. S. as an exempt overland import.

Originally, oil being handled in this manner amounted to only about 15,000 bbl. daily, but the volume increased rapidly. It reached a flow of 43,000 bbl. daily last week.

The continuing rise brought sharp objections from U. S. producer groups and spurred Interior to seek some way to bring such imports under control.

Those attending the meeting last week included Interior Secretary Stewart L. Udall, Assistant Secretary John M. Kelly, Juan Gallardo and Julian Saenz of the Mexican Embassy in Washington, and Serapion Fernandez and Manuel Leiva, officials of Pemex.

Exempt Imports to Be Issue

. . . at hearing on West Coast. District 5 refiners are concerned about flow of exempt Canadian imports.

INTERIOR Department's crude-oil import-control hearings are getting under way.

The first will be held Thursday in Los Angeles. The second will be May 10-11 in Washington.

The meetings will be wide open to anyone with anything to say about any phase of the current oil-import-control regulations.

Mostly, what will be said at these hearings will be a rehash of old arguments over what should be the proper level of crude imports, whether inland refiners deserve a quota, and so on.

After the hearings Interior will start pondering what changes it should make, if any.

Such changes might be made effective for the last half of this year. But a decision might be postponed to give Interior more time to make an exhaustive study of all aspects of the program.

The slower approach has been indicated in some recent comments by Interior officials. They charged that in the past—under the previous administration—decisions were made hurriedly and without sufficient study.

West Coast . . . One of the chief issues at this week's California meeting undoubtedly will be the exempt Canadian imports.

The imports into District 5, particularly the Puget Sound area, have been rising steadily.

Because the exempt Canadian import totals are deducted from West Coast demand figures before District 5 import quotas are set, the increase in the flow from Canada reduces the total that may be imported from abroad.

As a result, some West Coast oil firms are urging Interior to make some change to offset this situation.

Canadians feel that an outlet for their western crude in the Puget Sound area is vital to their own program. Furthermore, they say it is not hurting domestic producers because the Canadian crude is largely replacing oil imports from the Far East.

Other issues, too, may be aired at this week's meeting.

Small refiners will argue:

. . . That crude-import levels should be raised for District 5.

. . . That Interior should rescind the January action which requires a deduction from demand estimates of all products and crude shipped into Districts 1-4 from District 5 in excess of such shipments in 1958.

. . . That quota percentages for small refiners should be increased.

Districts 1-4 . . . The major battle of the imports-control campaign will be fought in Washington next week.

The biggest development undoubtedly will be an effort by producers to get the basis for import quotas tied to domestic crude demand.

There is a reason to believe that Interior will give this approach a great deal of consideration.

Other debates will center on quotas for inland refiners, on the percentage of imports that should be set aside for "historical" importers, and on the role to be played by condensates and natural-gas liquids in determining crude-import quotas.

Submarine pipeline proposed to platform off California coast

A NEW oil field is about to go on production off the coast of California.

Phillips Petroleum Co. has applied for permission to lay a 2-mile submarine line from the platform "Harry." The company plans to lay two 6-in. lines and one 4-in. line to move production to onshore facilities.

The platform is located in Parcel E in the Gato area off Santa Barbara County. It is in water 95 ft. deep. Five wells have been drilled from the platform, which is designed to handle 33 wells.

Oil, Gas Will Help Lick India's Food Plight

• A nation bent on stepping up its agricultural resources looks to oil and gas industries to supply feedstocks for nitrogen-fertilizer projects. In next 5 years, $500 million will be spent on expanding fertilizer capacity.

This is the third in a series of articles on India, a country that promises to become one of the world's most important markets in a matter of decades.

Ray G. Gibson
District Editor

INDIA IS TURNING in a big way toward oil and natural-gas products to help it solve a centuries-old problem of feeding its huge population.

More than $500 million will be invested in nitrogen-fertilizer projects by 1966 in a program started last year. Capacity in this period will increase nearly fivefold to 1.2 million tons per year.

About $227 million of this investment will consist of foreign exchange.

Another $20 million in foreign exchange will be needed to more than triple superphosphate fertilizer production from the current 300,000 tons capacity to 1 million tons per year.

Many of the projects have either received licenses or have reached the advanced-planning stage. Here are some of them:

. . . California Chemical Co., International Minerals & Chemical Corp., Skokie, Ill., and a local fertlizer producer, E. I. D. Parry, Madras, will build a $55-million complex on the east coast of India to produce 350,000 tons of fertilizer a year.

Basic feedstock will be naphtha from Caltex's 15,000-bbl. Visagapatnam refinery. The various types of chemical fertilizers will include 80,000 tons of nitrogen fertilizer, 80,000 tons of phosphorus pentoxide, and 16,500 tons of urea.

California Chemical and International Minerals will be minority stockholders in a new Indian company which will be set up to build the plant. Private Indian investors will be invited to participate.

. . . A 50,000-ton urea plant and a 50,000-ton ammonium-sulphate plant based on natural gas from Nahorkatiya oil field will be built by the government-owned Fertilizer Corporation of India, Ltd.

Tenders have been invited for the project which also will include an ammonium-synthesis plant with gas reforming and purification facilities, and sulphuric-acid plant.

Only firms operating in the United Kingdom are eligible to bid. This is because foreign exchange in pounds sterling for the project has been supplied by the British Government.

The fertilizer plant will be only one phase of a petrochemical industry based on Nahorkatiya gas.

Two licenses have been granted by the Indian Government to Duncan Brothers, Calcutta, for the manufacture of polyethylene and synthetic rubber. Phillips Petroleum will be an associate in the project.

Another license has been awarded to PJB Industries for the manufacture of carbon black. The company will be associated with Continental Carbon.

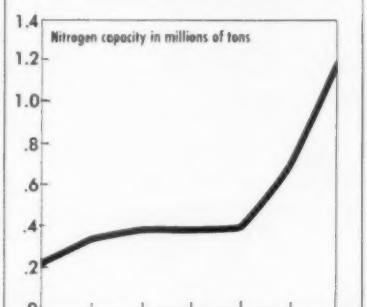
. . . A state-owned fertilizer plant at Trombay Island, Bombay, will be built with the help of a $30-million loan from the U. S. Development Loan Fund.

Feedstocks will include refinery gases from Burmah-Shell's 50,000-bbl. refinery, and naphtha from Stanvac's 38,000-bbl. refinery.

. . . Another fertilizer plant may be based on gases from a government refinery under construction at Barauni.

Another project being considered would be based on gas from coke ovens at a steel mill at Durgapur, West Bengal.

How India's Fertilizer Capacity Will Grow

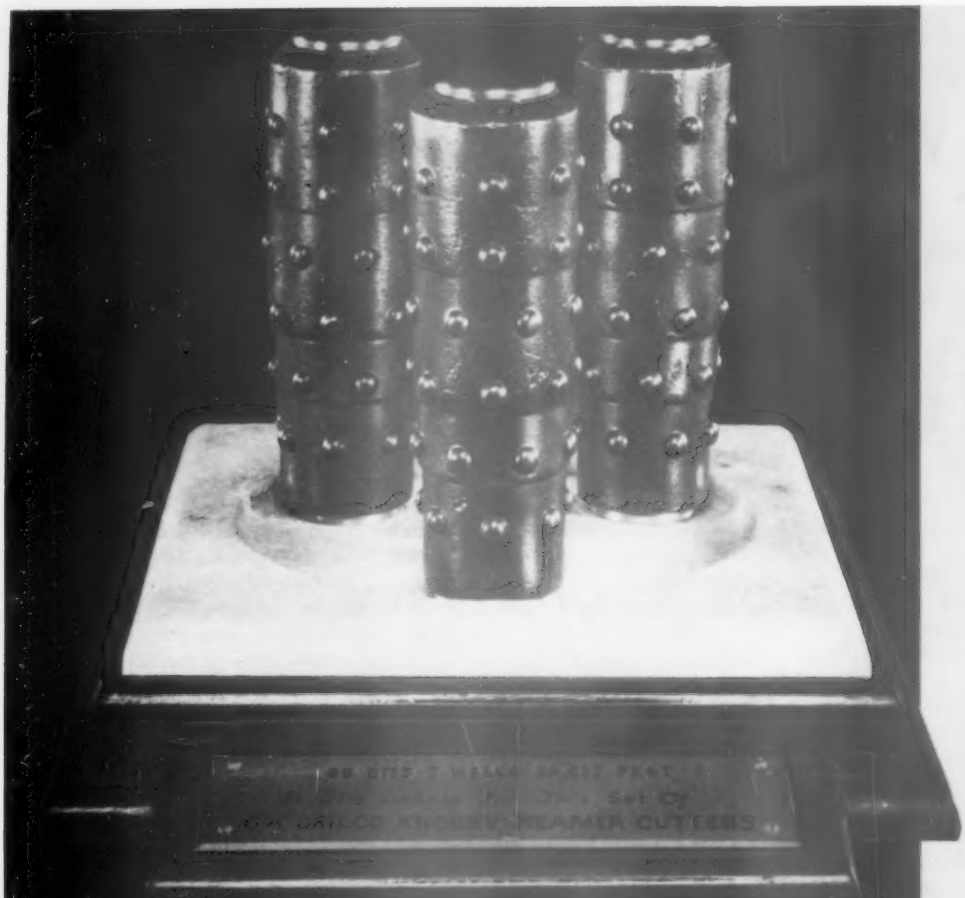


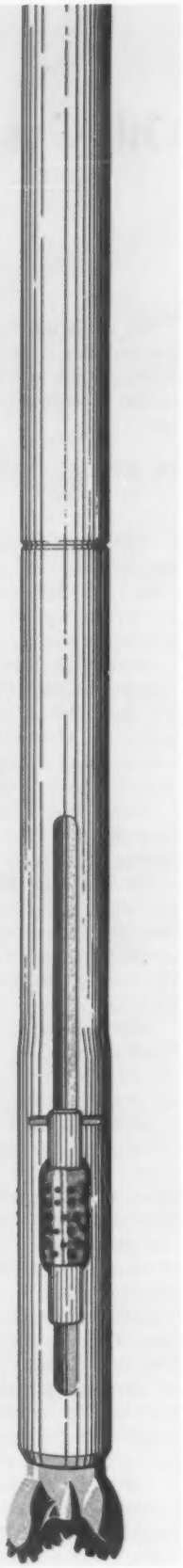
Investment Forecast

Sui gas . . . Natural gas from Sui and Mari fields in West Pakistan may become an important source of fertilizer feedstocks in India if negotiations for the sale of the gas are successful.

Sui gas is ideally suited to the production of synthetic fertilizer. One of the chief reasons for extending the Sui transmission system to Multan, West Pakistan, is to supply a 200-tons-daily nitrogenous fertilizer plant which will open in August.

Sui is operated by a Burmah-Oil Co. subsidiary. Mari, discovered by Stanvac, is shut in.





RECORD PERFORMANCE REAMING UNDERGAGE HOLES

Preserved for oil industry history, the above set of 6-¾" Drilco Knobby Reamer cutters compiled the tremendous record of reaming 24,622 feet of hole in seven wells.

They assured a full gage hole for 99 rock bits during a period from December 1959 to April 1960 for Dual Drilling Company's Rig #2 and Rig #6 in wells drilled in Crane and Pecos County, Texas, and Lea County, New Mexico.*

Reamer costs were cut 50% and reaming to the bottom with a new rock bit was eliminated. Performance like this has made the Drilco Knobby Reamer a sensational money-saver in terms of maximum performance at minimum cost, while assuring the user of NO undergage hole problems.

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Italian Refiners Sue Esso

ANOTHER major legal battle over the performance of refining facilities has erupted with the filing of a $41-million lawsuit against Jersey Standard and Esso Research & Engineering Co. by two Italian companies.

The breach-of-contract suit has been filed in federal district court in Newark, N. J., in behalf of Asienda Nazionale Idrogenazione Combustibilis, SPA, and Stanic Industria Petrolifera, SPA, both of Milan.

The companies are seeking damages, including loss of profits, on the grounds that processes licensed by Esso Research have not met design specifications.

Units involved are a 7,300-bbl. Powerformer at a 49,000-bbl. Bari refinery and an 8,900-bbl. fluid Hydroformer at a 47,000-bbl. Leghorn refinery. Both units were put on stream in 1958.

Both refineries are owned by Stanic Industria, which is owned jointly by ANIC and Jersey Standard. ANIC is controlled by the Italian Government agency, ENI, headed by Enrico Mattei.

Each of the Italian firms is seeking damages of $20.5 million in the complaint filed by Shanley and Fisher, a Newark law firm.

ANIC is asking $10,250,000 in damages from Jersey Standard, and an equal sum from Esso Research. Stanic is seeking $20.5 million from Esso Research.

Jersey Standard, before it had a chance to see the complaint, said it is convinced the fluid Hydroformer will ultimately meet design performance established for it.

Regarding the Powerformer at Bari, Esso Research said it was advised in July 1960 that the unit was not meeting design. It submitted a proposal in October which it believed would substantially resolve the difficulties.

Esso Research said it has not received a reply to the proposal, nor a reply to an amplification submitted in March.

South-West Africa Survey Planned

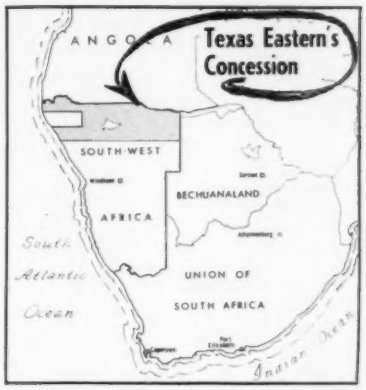
TEXAS Eastern Transmission Corp. has awarded a contract to Hunting Surveys, Ltd., London to make a detailed flying magnetometer survey of a 90,000-sq.mile concession in this northern part of South-West Africa.

Texas Eastern obtained the concession from the territorial government last year and has been conducting preliminary surface geological studies.

The company said it has found that much of the concession lies in a basin of marine deposits.

Findings of Hunting Surveys will determine the extent of future geophysical work and stratigraphic drilling.

The huge concession extends along South-West Africa's northern boundary, east to Bechuanaland, and generally south about 150 miles.



Texas Eastern operates in the country through a subsidiary, Ettsha Petroleum Co., with headquarters in the capital at Windhoek.

FOREIGN BRIEFS . . .

An offshore discovery in the Gulf of Suez, off Sinai Peninsula, has been made by Cie. Orientale des Petroles. The find was made at 6,910 ft. in a concession in Belayim Bay, 125 miles south of Suez.

Three more crudes are being posted by Cia. Shell de Venezuela at its new Puerto Miranda terminal in Lake Maracaibo. The crudes, formerly posted at Cabimas, are: Cabimas, 22°-22.4° gravity, $2.07 per barrel; Tia Juana Mediano, 20°-20.4° gravity, $1.97; and Tia Juana Pesado, about 12°-13° gravity, $1.67.

Construction will start soon on a 72,000-bbl. Esso AG refinery at Karlsruhe, Germany, which will be supplied by the 475-mile big-inch pipeline from Lavera, near Marseille, to West Germany. The plant is expected to go on stream by January 1963.

A contract to build England's first butyl-rubber plant, a $12.5-million installation for Esso Petroleum Co., Ltd., has been let to Foster Wheeler, Ltd. The plant, which will have a yearly capacity of more than 25,000 tons of the elastomer, will be constructed this year at Esso's Fawley refinery.

Four out of 10 bbl. of crude imported by West Germany last year entered through Wilhelmshaven, the North Sea terminal of the new Wilhelmshaven-Ruhr pipeline system. Hamburg and Brunsbeuttelkoog, oil ports on the Elbe River, were in second place. They handled about 1 bbl. out of three, or 33.2% of imports.

British Petroleum plans to increase the capacity of its 120,000-bbl. Aden refinery to about 145,000 bbl. daily. Cost will be about $1,500,000. Minor additions and modification of existing units will bring about the higher throughput. BP expects to complete the expansion this year.

Main contractor for a steam-cracking plant which will be the center of the Stenungsund petrochemical complex in Sweden is Fluor Corp., Los Angeles. The plant, which is being constructed for Svenska Esso, is due to go on stream by July 1, 1963.

Crude Flow Shoots Up

- **Saudi Arabia tops 1.5 million barrels daily for first time, driving foreign output to record high in February.**

RECORD production in the Middle East and a near record in Venezuela pushed foreign crude production to another all-time high in February.

The high level in the Persian Gulf area resulted from Saudi Arabia's passing the 1,500,000-bbl.-daily level for the first time in history. Saudi output combined with high production in Kuwait and Iran more than offset a decline in Iraq.

Venezuelan output of 3,082,000 bbl. daily was within 13,900 bbl. daily of the country's best producing month, February 1959.

Algerian production rose another notch to 323,100 bbl. daily. This gave Algeria ninth place among the free world's producing countries. It has risen from fourteenth place in the past year.

TREND OVER THE LAST YEAR

(Thousands of barrels)

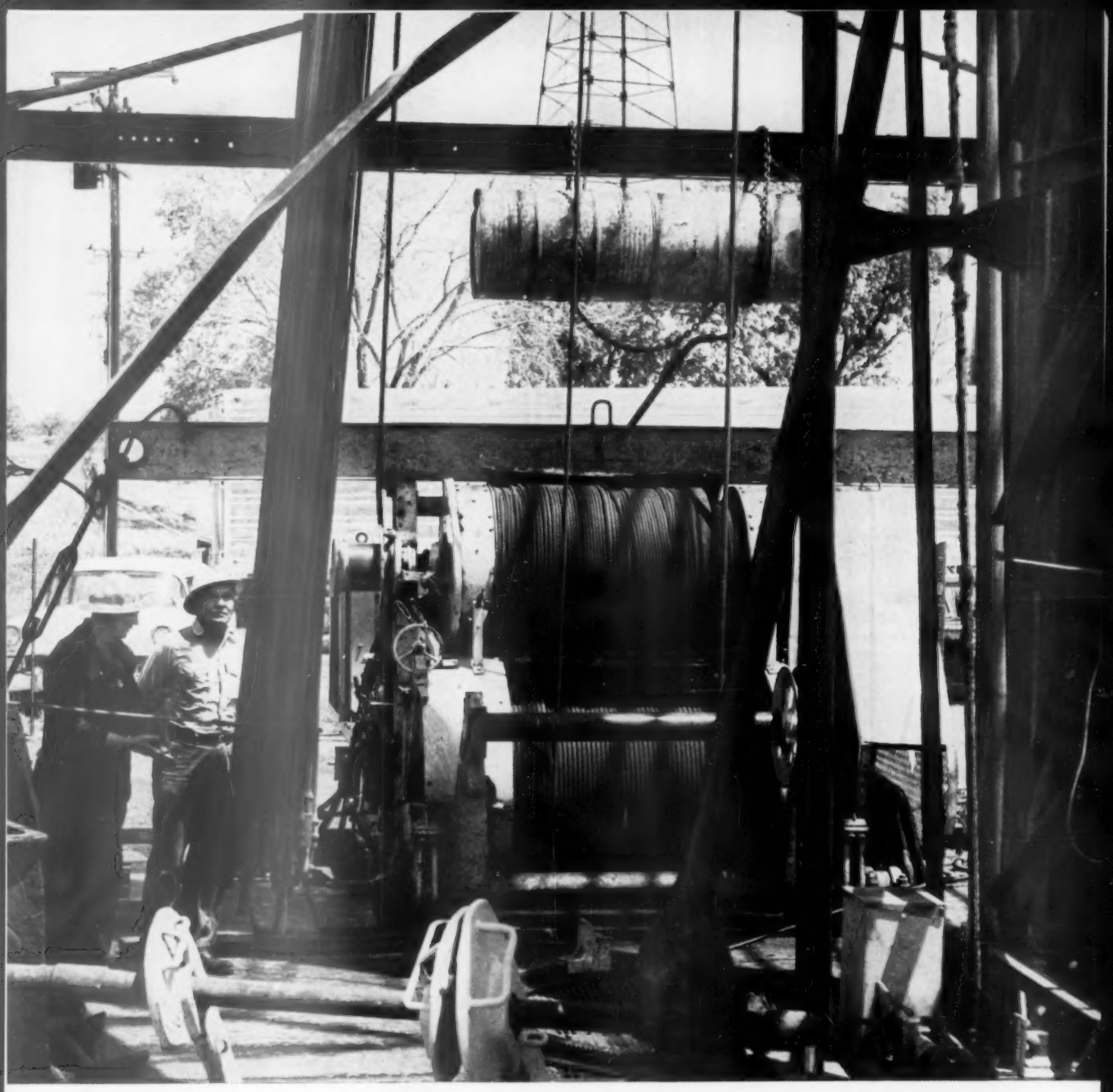
	Western Hemisphere less U. S.	Middle East	Total free world outside U. S.
1960			
February	4,332.4	4,992.6	10,324.0
March	4,156.4	5,146.3	10,346.8
April	4,069.5	4,925.5	10,055.1
May	4,317.4	5,286.2	10,680.2
June	4,285.4	5,164.5	10,568.2
July	4,214.2	5,103.5	10,448.2
August	4,320.1	5,146.8	10,602.5
September	4,311.3	5,500.2	10,941.3
October	4,243.9	5,630.6	11,104.5
November	4,206.8	5,482.2	10,964.2
December	4,341.2	5,550.1	11,152.2
1961			
January	4,591.3	5,568.1	11,412.8
February	4,623.9	5,697.7	11,578.6

World-Wide Crude Production: Daily average in thousands of barrels

Country—	Feb. 1961	Jan. 1961	Feb. 1960
Western Hemisphere			
Argentina	239.1	239.1	139.7
Bolivia	8.1	7.8	8.8
Brazil	92.0	92.0	74.4
Canada	577.2	587.0	548.5
Chile	22.0	22.0	18.8
Colombia	145.6	152.7	156.4
Cuba	0.2	0.2	0.5
Ecuador	7.7	7.7	7.6
Mexico	271.0	271.0	261.8
Peru	52.5	52.5	52.2
Trinidad	126.5	126.5	117.7
Venezuela	3,082.0	3,032.8	2,946.0
Total	4,623.9	4,591.3	4,332.4
Europe			
Austria	44.6	44.6	46.2
France	41.4	38.1	37.0
West Germany	114.0	112.9	101.4
Italy	38.3	33.2	31.4
Netherlands	39.1	38.5	33.4
United Kingdom	1.7	1.7	1.7
Yugoslavia	22.2	21.2	11.5
Total	301.3	290.2	262.6
Middle East			
Bahrain	45.0	45.1	45.0
Iran*	1,167.0	1,121.0	1,008.0
Iraq†	948.8	1,034.2	920.0
Israel	2.3	2.3	2.4
Kuwait	1,615.5	1,596.3	1,452.0
Neutral Zone	152.2	145.3	128.0
Qatar	177.3	180.8	183.6
Saudi Arabia	1,547.2	1,436.7	1,245.8
Turkey	6.4	6.4	7.8
Total	5,697.7	5,568.1	4,992.6

Country—	Feb. 1961	Jan. 1961	Feb. 1960
Other Asia			
British Borneo	92.0	92.0	100.3
Burma	10.5	10.5	10.7
India	8.5	8.5	8.5
Indonesia	391.7	407.7	384.3
Japan	10.3	10.3	9.1
New Guinea	3.4	3.4	4.1
Pakistan	5.9	5.9	5.9
Total	522.3	538.3	522.9
Africa			
Algeria	323.1	315.0	118.8
Angola	1.2	1.2	1.0
Egypt	70.2	70.2	59.3
Gabon	15.4	15.1	15.2
Middle Congo	2.1	2.0	.....
Morocco	1.8	1.8	2.1
Nigeria	19.6	19.6	17.1
Total	433.4	424.9	213.5
Free World			
Foreign	11,578.6	11,412.8	10,324.0
United States	7,331.0	7,210.0	7,241.0
Total	18,909.6	18,622.8	17,565.0
Communist Countries in Soviet Orbit			
Romania	231.0	231.0	231.0
Russia	3,190.0	3,190.0	2,843.0
Other Communist	100.0	100.0	100.0
Total	3,521.0	3,521.0	3,174.0
WORLD TOTAL	**22,430.6**	**22,143.8**	**20,739.0**

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes estimated 3,500 bbl. daily from Naft Khaneh field, operated by Iraq Government.



Bethlehem Wire Rope on Work-Over Job in Oklahoma. This well-servicing unit, operated by Standard Drilling Company, is cleaning out a well in Oklahoma City. The Bethlehem wire ropes used were: Drilling Line—7,500 ft of 7/8-in. Non-Preformed, improved plow steel, with fiber core; Sand Line—8,000 ft of 9/16-in. Form-Set, improved plow steel, with fiber core. Bethlehem Wire Rope is used widely on well-servicing units because of its dependability. Cores available include: fiber, plastic-treated fiber, and solid plastic. We can also supply plastic filament rope-laid core.

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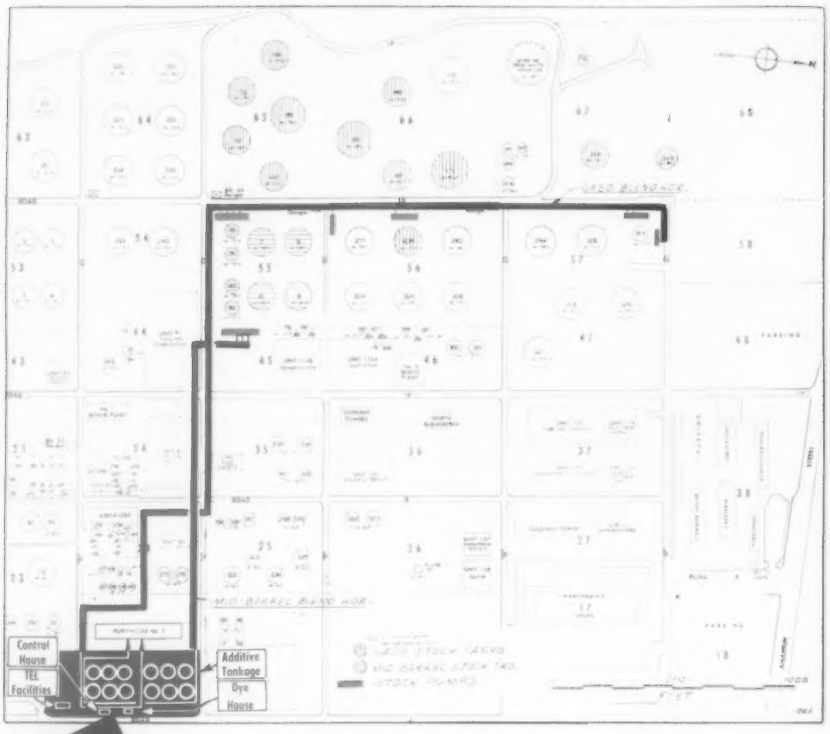
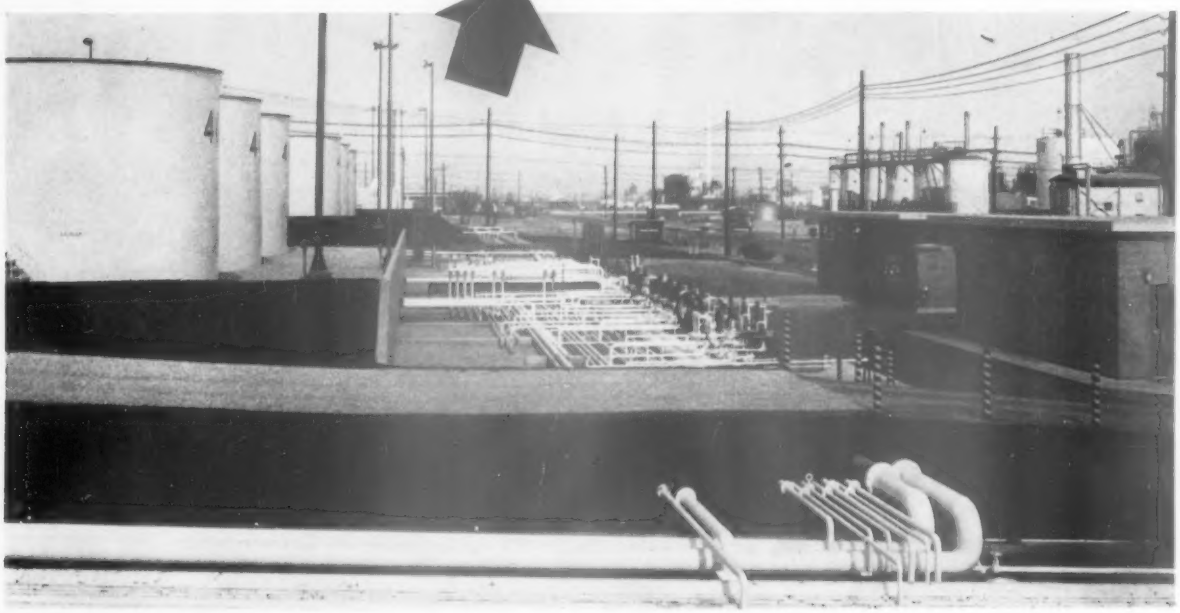
Union Oil's new

Electronic gasoline and midbarrel blender

has been exceeding all expectations

BY ARTHUR F. STRIBLEY, JR.,
M. W. ADCOCK, AND
J. F. HANNAMAN





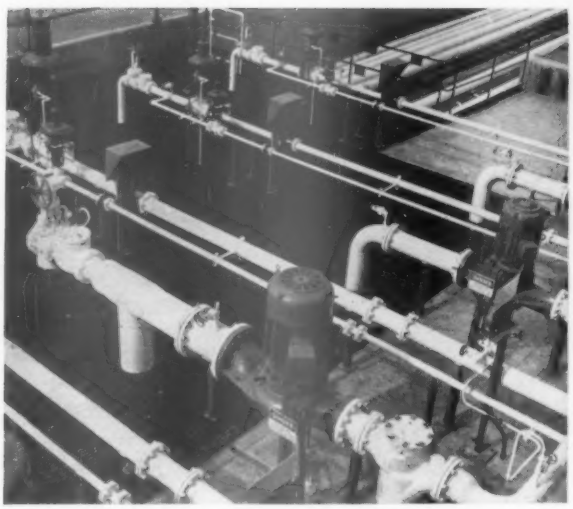
BLENDER CONTROL CENTER is located in southeast part of Union Oil's Los Angeles refinery. Additive solution tanks are at left, additive control stations are at center, and additive structure is at right. Figs. 1 and 2.

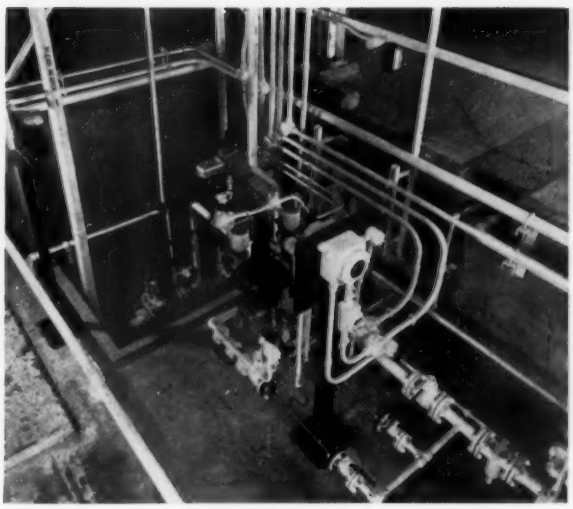
AN ELECTRONICALLY controlled in-line blending system for gasoline and distillate fuels has been operating without difficulty at the Los Angeles refinery of Union Oil Co. since January 1961. The $1,500,000 facility takes suction from stock tanks which are as much as a mile away. Gasoline stocks are transferred in a single header, and midbarrel stocks are blended and transferred in a separate header.

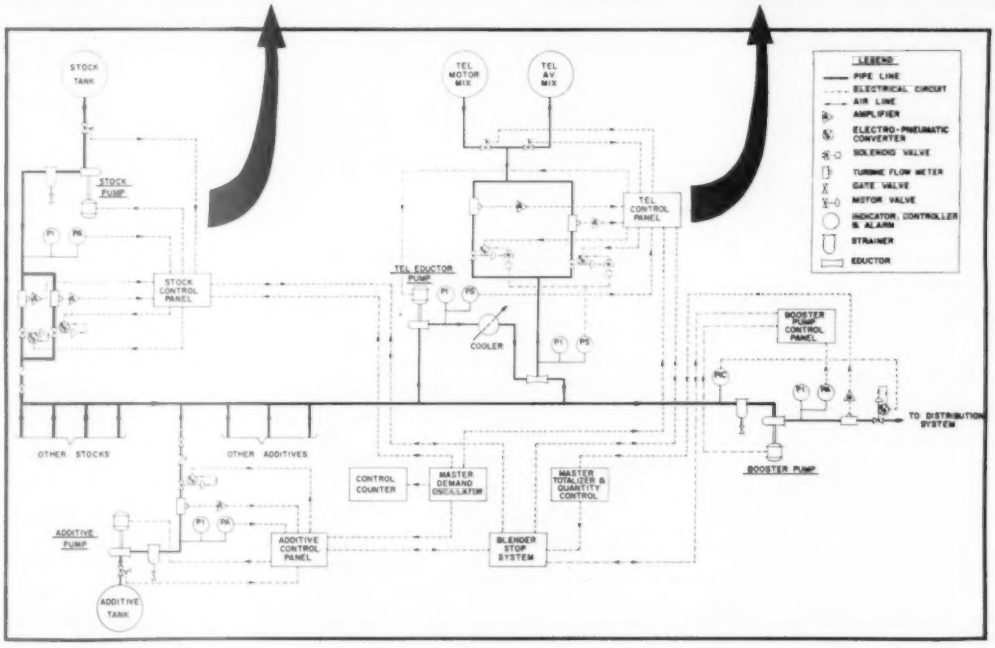
Several million barrels of various grades of motor gasoline, aviation gasoline, and JP-4 fuel have been produced with the blender, and production has been on-grade in all cases.

Unusual features of the system include:

- Distance of blender away from stock tanks. Usually, an in-line blender is located adjacent to the tanks.







BLENDER FLOW SCHEME utilizes in-line centrifugal pumps and turbine meters. At top left is battery of typical stock control stations. At top right is TEL metering and control equipment. Figs. 3, 4, and 5.

- Use of turbine meters throughout as primary flow-measuring devices.
- All-electronic solid-state control equipment. Uniformity and interchangeability are features.
- New in-line self-contained centrifugal pumps, designed specifically to meet Union Oil Co. specifications.
- Use of dual meter and motor-valve systems for all gasoline stocks, to allow wide blending flexibility.

Refinery revamp. The blending system was installed as part of an over-all refinery-construction program which included the installation of a new gasoline catalytic reformer and several Unifiners. The new units needed the tankage which was being used by the batch blending system.

Consideration was then given to the problem of whether to construct a continuous in-line blending system, or to construct new tankage to continue stop-set batch blending. Union Oil's Oleum refinery has successfully used in-line blending since 1955. Thus, careful consideration was given to the use of this technique at the Los Angeles plant.

Cost estimates showed the two systems were about equal in cost. But the blender needed much less space and would be more flexible and accurate, while requiring less manpower. These conclusions led to detailed study of in-line blending.

Obvious best site for a blender was on the east side of the refinery, near TEL facilities and the refinery shipping center. But this location averaged ¾ mile from the gasoline-blend stock tankage, located in the northeast part of the plant, Fig. 1.

Since no blending system had ever

The authors

Arthur F. Stribley, Jr., is design supervisor for the new refined-oil blending unit. He has been with Union Oil since 1941, when he graduated from University of California with a degree in chemical engineering. He has worked in chemical research, sales research, economics, process design, and startup of new units. Stribley is a member of AIChE.

M. W. Adcock is in Union Oil's Los Angeles refinery engineering department, where he works on instrument design applications and corrective maintenance problems. He has been with Union nearly 33 years, during which time he has served as instrument technician, instrument foreman, and maintenance instrument engineer. Adcock is a member of ISA.

J. F. Hannaman is supervisor of major plant additions to Union Oil's refineries. He has worked out of the company's head-office engineering and construction department since 1950. He has been with Union since 1942, when he graduated from University of California with a degree in chemical engineering. Hannaman is a registered engineer.

been constructed this far from tankage it was necessary to design a system specifically for this application.

Design Criteria

The requirement for remote control over distances of up to a mile made it essential that some form of electric transmission be used. The possibility of using turbine meters was considered, since this flow-measurement device gives a digital output signal proportional to flow which can be readily transmitted. It also offered the advantages of (1) ease of installation in remote locations, (2) not requiring a foundation, (3) wide linearity, and (4) high accuracy, with flow rates ranging from less than 1 g.p.m. to thousands of gallons per minute.

Based on the possible use of turbine meters as primary flow-measuring devices, the following design criteria were established:

1. All stocks would be pumped, metered, and controlled in the field adjacent to blend stock tankage.
2. All stocks would be metered into a single blend header which would be piped to the blender control site where additives and TEL would be metered in.
3. Control system should be digital for maximum accuracy and ease in system trouble shooting, since turbine-meters outputs are digital.
4. The electronic control equipment should be all solid state.
5. Stock compositions should be directly settable in per cent of blend, additive solutions in barrels per thousand barrels of blend, and TEL in c.c.'s per gallon.
6. Additive solutions and TEL addition should be measured using turbine meters and be handled in a similar manner to blend stocks.
7. The unit would handle the entire spectrum of refined-oil products from aviation gasoline to diesel fuel.
8. The blending unit would be a one-man operation.

Experimental Program

Literature on turbine meters in refining applications was rather sketchy and limited to use in crude and product custody-transfer work. Consequently, we decided to test a small-sized turbine meter in as difficult a service as possible.

The main objectives of the test were to determine the accuracy, repeatability, and long-term reliability of such meters. A 1-in. FF series meter was borrowed from Waugh Engineering Co., a local turbine-meter manufacturer, and placed in a bypass line in the refinery TEL addition system. This was a new type of meter, with the rotor being supported on a fluid film for essentially frictionless operation.

The meter test was conducted over a period of 8 months, during which more than 4,000,000 lb. of TEL was metered. The accuracy of the meter was ±0.25% compared with the system weigh scale. No maintenance was required on the meter during the test. The meter on disassembly was found to be in excellent condition, showing essentially no wear after the 8 months' service.

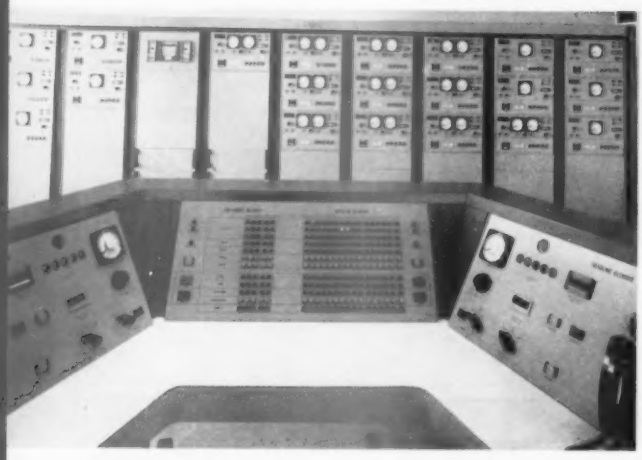
The success of this test led to ordering an 8-in. turbine meter for installation in a refined-oil-product shipping line. This test was conducted over a several-month period, during which over 4,000,000 bbl. of refined products was handled. The meter proved to be highly accurate and reliable. The accuracy was ±0.25%, compared with tank gages for delivery batches ranging from 15,000 to more than 60,000 bbl.

Control tests. Another concurrent test was run on a bread-board digital-control system. This system used standard digital counting equipment and was set up to control a single component. The bread-board tests were conducted over a period of about 1 month and proved conclusively that excellent control of predetermined ratios could be obtained. Certain refinements in circuit logic were indicated, but the design problem was primarily one of packaging rather than of basic development.

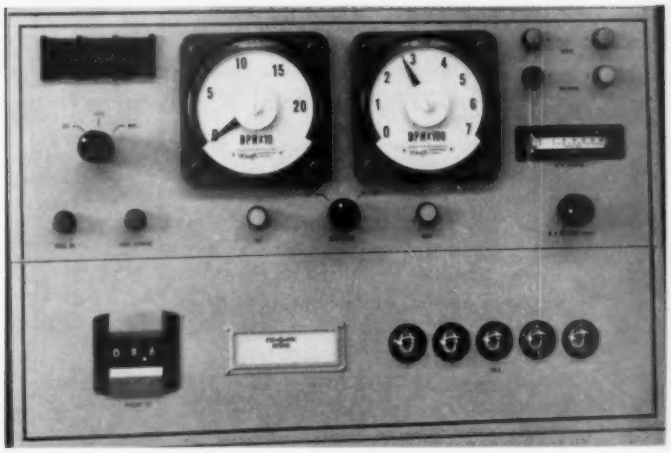
The experimental program proved the reliability of turbine meters, demonstrated the feasibility of accurately ratioing and controlling streams using digital electronic equipment, and confirmed the adequacy of this particular unique control concept.

As a result, a design specification suitable for engineering the blender was prepared. This specification was detailed in most respects but did not fix the type of control equipment or system concept to be used.

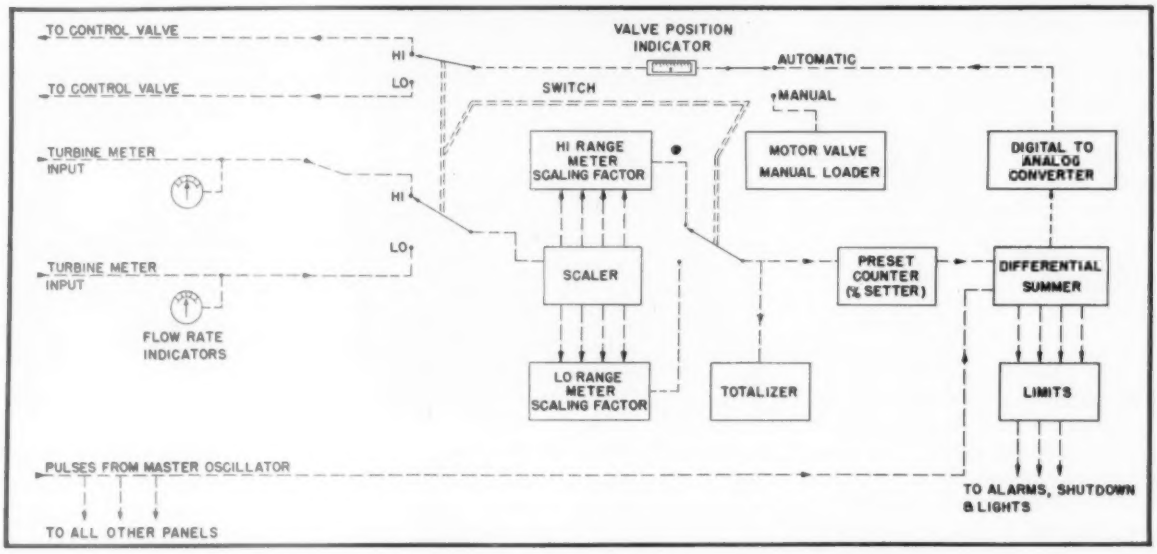
A contract was negotiated with Fluor Corp. for engineering and construction of the blender. Engi-



CONTROL CONSOLE, foreground, has monitoring lights in center and two master control panels in wing sections. Individual stock and additive control panels are in background cabinet. Fig. 6.



TYPICAL CONTROL PANEL. Flow meters, operating lights, and alarm lights are in upper section. Stock per cent set switch and totalizer readout are in lower section. Fig. 7.



PANEL ELECTRIC DIAGRAM shows the heart of the control system. Fig. 8.

neering work on this project was started by Fluor in September 1959.

Selecting Control Equipment

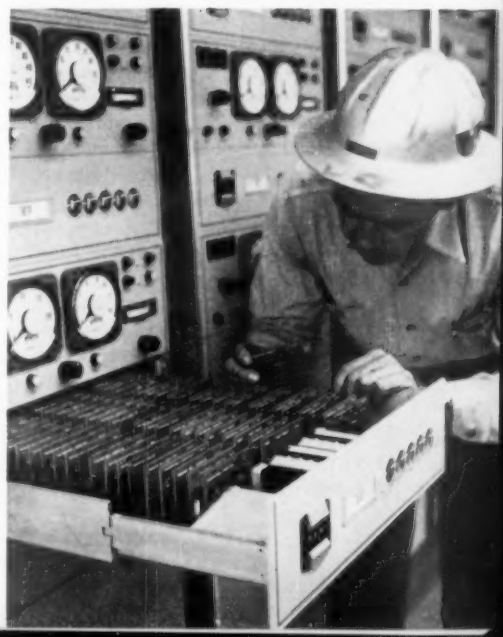
The immediate problem faced by Fluor and Union before detailed engineering work could proceed was selection of the control equipment. While Union's test program indicated that the experimental digital control system was feasible for the blending operation, we felt that other control techniques should be explored for possible application. Consequently, a detailed instrument specification was prepared by Fluor.

This specification defined all requirements of the system: i.e. design blend rates, control flow ranges of all stocks and additives, number and combination of stocks and additives to be controlled, control accuracy limits and alarm, shutdown and memory features of the system.

In general, three different methods of controlling the blender were considered. These were as follows:

1. The "functional" approach: individual digital control loops for each stock and additive station.

2. Time-shared, programed control: using a medium-size general-purpose computer.



TYPICAL CONTROL DRAWER (lower part of Fig. 7) opens to reveal lower panel chassis which contains 62 digital printed-circuit modules. These control the logic of the system. Fig. 9.

3. Combinations of both the functional and computer approaches.

After considerable analysis, the functional system was selected for these reasons:

1. It offers greater reliability, in that the individual control panels for each station are identical and can be readily repaired or spared by a panel not in use in the event of a failure. Trouble shooting and minor repairs can be made by refinery technicians.

2. It is simpler and more understandable by refinery operators and maintenance people than the computer approach.

3. Cost is competitive.

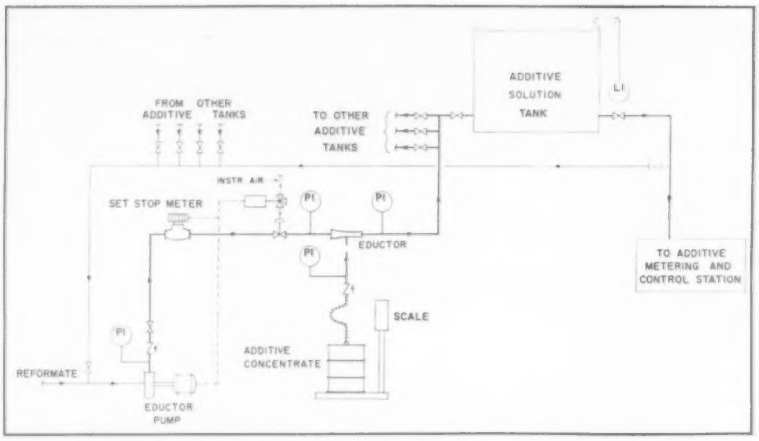
Waugh Engineering Co. was awarded the contract by Fluor and Union Oil to furnish the entire electronic control system, complete with turbine meters and amplifiers. Packard Bell Computer Corp. was selected by Waugh to manufacture the bulk of the electronic components and to package the control system.

Field forces started construction March 1960 and completed the plant during December of that year. The unit was constructed for an over-all cost of $1,500,000 which included yard-piping revisions. A general view of the blender control center is shown in Fig. 2.

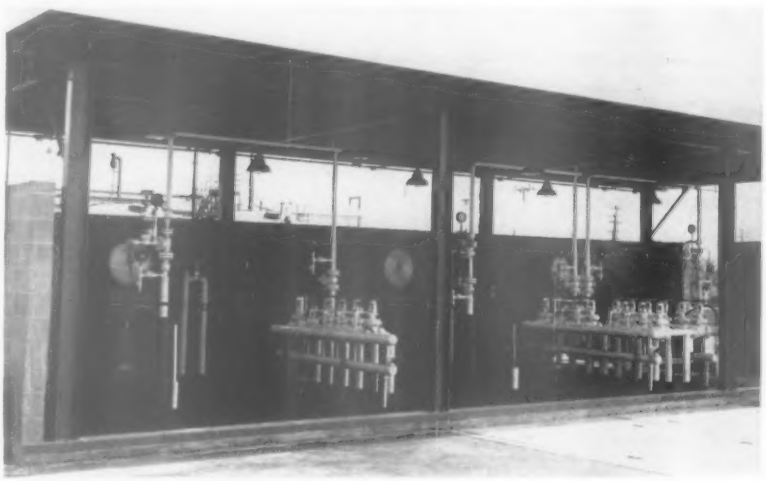
How It Works

The refined-oil blending unit consists of two separate continuous in-line automatic blenders. The gasoline unit is designed to blend motor gasolines, aviation gasolines, and jet fuel at rates of from 2 000 to 5,000 bbl. per hour. The midbarrel unit, which can be operated simultaneously, is designed to blend turbine fuel and diesel fuels at rates from 2,000 to 3,500 bbl. per hour. The gasoline blender is equipped to blend continuously up to 10 different stocks, 5 additives, and TEL. The midbarrel blender is arranged to blend continuously three different stocks and two additives.

The stocks flow from tankage and are boosted using vertical in-line centrifugal pumps through turbine meters and control valves into the blend header, Fig. 3. The in-line centrifugal pumps were supplied by Pacific Pumps, Inc., and were manufactured as a new product line to meet Union's requirements. This type of pump is a self-contained unit which flanges directly into the line, does not require a base plate or foundation, and does not need field alignment of pump and driver.



ADDITIVE PREPARATION involves mixing dry dyes and liquid additives into reformate by means of a pump-eductor system. Fig. 10.



ADDITIVE MIXING EQUIPMENT. Eductors are located in the vertical piping, center of each bay. Additive concentrate drums are spotted on floor surrounding eductor piping. Concentrate is siphoned into circulating solution with probes shown in foreground. Fig. 11.

Blending flexibility. Although turbine meters have wide linearity, dual meter and motor-valve systems are provided for all gasoline stocks and TEL to allow for wide blending flexibility. For example, reformate blending stock is designed for accurate metering in concentrations as low as 5% of a 2,000-bbl. per hour rate, to as high as 70% of the maximum 5,000-bbl. per hour rate. This requires a meter range of 35 to 1. Table 1 shows the wide degree of rangeability necessary where compositions, and hence flow rates, must vary widely to meet all blending requirements.

Switching meter range. This is accomplished remotely from the control panel and can be done while the blender is in operaton. Isolation of the unused meter system is obtained using the associated motor valve. All control motor valves are of the single-seated type, equipped with bubble-tight teflon seats.

The stocks are added from pump, meter, and control stations located adjacent to the stock tanks, and the mix flows down the blend header to the blender control area. Typical stock-control stations are shown on diagram, Fig. 4. Turbine meters in sizes ranging from 1½ to 6-in. are used for the stocks.

Additives are added with horizontally mounted centrifugal pumps taking suction on solution tanks located in the blender area and discharging through turbine meters and

TABLE 1—DESIGN-FLOW DATA—GASOLINE BLENDER

Stock—	Control Station	Minimum Flow Requirements: Min. Stock % at 2,000 bbl./hr. Blend Rate	Minimum Flow Requirements: Flow Rate Bbl./hr.	Maximum Flow Requirements: Max. Stock % at 5,000 bbl/hr. Blend Rate	Maximum Flow Requirements: Flow Rate Bbl./hr.
Reformate 1) Unifinate)	1	3	100	70	3,500
Reformate 2) Lt. straightrun)	2	5	100	70	3,500
Av. base stock) Turbine Stock)	3	5	100	50	2,500
Butane	4	1	20	10	500
Isopentane	5	1	20	15	750
Alkylate	6	5	100	50	2,500
Lt. thermal gaso.	7	2	40	25	1,250
Lt. cat. gaso.	8	2	40	25	1,250
C5-C6 gaso.	9	2	40	25	1,250
Hvy. cat. gaso.	10	2	40	25	1,250
Additives	11-15	1 B/1,000 B Blend	2	3 B/1,000 B Blend	15
TEL	16	0.5 cc/gal.	0.3 g.p.m.	5 cc/gal.	7+g.p.m.

TABLE 2—METER-BALANCE DATA

Blend No.	Sum of All Stock and Additive Meters bbl.	Blend Total Meter bbl.	Receiving Tank Gage bbl.	Deviation from Tank Gage, %: Stock and add.	Deviation from Tank Gage, %: Blend Total
1	65,140	65,000	64,960	+ 0.28	+ 0.06
2	46,461	46,400	46,242	+ 0.47	+ 0.34
3	64,601	64,450	64,415	+ 0.29	+ 0.05
4	63,721	64,000	64,016	— 0.46	— 0.02
5	75,229	75,000	74,908	+ 0.43	+ 0.12
6	75,112	75,000	74,982	+ 0.17	+ 0.02
7	64,898	65,000	65,037	— 0.21	— 0.06
8	85,316	85,000	85,188	+ 0.15	— 0.22
9	80,000	80,000	79,813	+ 0.23	+ 0.23

control valves into the blend header. One-half-inch meters are used in the additive systems.

Motor-mix or aviation-mix TEL is educted from existing weigh tanks through either a high (⅝-in.) or low (⅜-in.) range turbine meter and associated control motor valve into the blend header. An auxiliary pump circulating a slip stream from the blend line provides the motivating power for the eductor.

A booster pump, located at the shipping center adjacent to the blender, takes suction on the blend header and boosts the finished gasoline into the desired shipping system, either inside or outside the refinery.

A vapor-pressure recorder and continuous sampler are set up at the discharge of the booster pump as guides for the operator. The continuous sampler allows the operator to obtain 4-hour composite samples of the blender production.

The entire operation is controlled at the blend center using the electronic control equipment. All signals are transmitted by four overhead cables run on a pole line installed exclusively for this purpose. Cable No. 1, consisting of multiple shielded twisted pairs, transmits remote meter signals to the blend center. Cable No. 2 handles 10-50-ma. motor-valve-positioning signals. Cable No. 3 transmits "open-close" signals on isolation valves located at the in-line pump suctions. Cable No. 4 transmits motor-start and pump-pressure signals.

Control System

The digital electronic control system operates on the principal of continuous comparison of the total accumulated flow of each stock to the total accumulated signal from a master demand oscillator. The output from each turbine meter is a pulse signal in which each pulse represents a fixed quantity of fluid. The turbine-meter output, after scaling and ratioing, feeds into an electronic differential summer which compares the total adjusted turbine meter signal to the total number of pulses from the master demand oscillator.

Any difference in the totals is converted into a d.c. signal, amplified and transmitted to position the corresponding control valve. In this manner the control system gives essentially absolute accuracy in ratioing. Union Oil Co. and Waugh Engineering Co. have patents pending on this principal of control.

Referring to Fig. 8, the meter pulse signal, which varies from 10 to 100 mv., depending on the flow rate, is amplified to a 10-volt square-wave pulse at a field-mounted amplifier. This step is necessary to allow remote transmission without noise interference. The amplified pulse signal is transmitted to the control panel where a rate meter reads out the flow directly in barrels per hour. The input signal feeds into an electronic scaler which multiplies the signal by the meter factor.

The meter factor is set on a four-digit switch located inside the panel. At the output of the scaler the signal has been adjusted to exactly 1,000 pulses per barrel of flow. The output of the scaler is fed simultaneously to the totalizer and to the balance of the control system. The totalizer divides the scaled signal by 1,000 and reads out in barrels.

In the control system, the scaled meter output is fed into a per cent setter which divides the signal by the per cent (or ratio) set. For example, if the composition of a certain blend calls for 25.0% of a particular stock, the per cent setter, set at 25.0, divides the input signal of 1,000 pulses per barrel by 250, yielding a signal of 4 pulses per barrel, or 1 pulse for ¼ bbl. of stock. This scaled-and-ratio signal is fed into an anticoincidence circuit and into the differential summer.

Differential summer. This is an electronic storage device which subtracts one count for each pulse received from the per cent setter and adds one count for each pulse received from the master demand oscillator. If the pulse rate from the master oscillator and the per cent setter do not agree exactly, the differential summer generates an error signal which is converted to d.c. by a digital-to-analog converter and then transmitted to reposition the control motor valve.

The master oscillator which controls the blend flow rate sends out one pulse for each barrel of blend. This signal is fed to all the stock

TABLE 3—LABORATORY RECORD HOUSEBRAND GASOLINE BLEND

Sample—	Time	R.v.p. p.s.i.	Gravity °API	Engler, °F. Init.	10%	50%	90%	Max.	Rec. %	CFRR	CFRM
Spot blender header	1230	8.2	...	100	136	214	380	420	98.0	92.6	...
Blender comp.	1620	8.3	...	96	140	220	382	422	98.0	...	...
Blender comp.	2020	8.4	...	104	138	218	384	422	98.5	92.2	...
Blender comp.	2220	8.0	...	96	138	220	388	424	98.0	92.1	84.2
Blender comp.	0020	8.3	...	92	139	220	385	419	98.0	92.2	...
Blender comp.	0420	8.4	...	99	140	220	374	420	98.5	92.2	84.1
Blender comp.	0620	8.4	57.9	96	138	220	381	420	98.0	...	...
Spot blender header	0830	8.5	58.2	90	132	214	384	418	98.0	92.1	...
Spot blender header	1030	8.3	58.0	98	140	220	388	424	98.0	92.1	...
Finished tank*	...	8.4	...	95	135	217	387	429	98.0	92.2	84.1

*Includes heel from previous blend.

and additive panels. The blend in the previous example will contain 25% of the stock, since the differential summer forces the stock system to deliver a pulse for every master oscillator pulse, and one pulse of the stock is equivalent to ¼ bbl.

The differential summer has capacity for storing pulses in excess of those required for normal control. This excess capacity serves as a memory to restore the proper blend ratio automatically after temporary upset, provided the remainder of the system is capable of responding to the correction called for by the control system. The differential summer memory also provides limit alarm points to actuate the alarm system when errors reach preselected values.

The d.c. motor-valve control signal from the differential summer is transmitted to the field where it actuates an electropneumatic positioner on the valve. This signal closes the control loop from the flowmeter to the control valve.

A blend total meter is provided which measures blend flow but does not enter into the control function. A total blend switch is provided which shuts down the blender at any predetermined volume of product blended. When the blend-total meter and the preset total are coincident, the blender automatically shuts down.

Control Room

The control equipment is contained in nine standard relay rack-type panels and a custom-designed console. This equipment is arranged as shown in Fig. 6 and is housed in a 24-by-26-ft. control room. Stock and additive controls are located in the panels and master controls in the console.

Considerable attention was given to the human engineering aspect of operating and maintaining the control panels and console. Every effort was made to provide a logical and accessible layout and arrangement of components. Ease of manipulating, monitoring, and maintaining were weighed carefully in the design stage.

Each stock and additive control panel consists of two drawers as shown in Fig. 7. The upper drawers contain the rate indicators, tank-select lights, error - and - shutdown alarm lights, and a control-valve-position indicator.

The lower drawers, with the exception of the TEL panel, are interchangeable. Each drawer contains 62 plug-in electronic modules which perform the control logic functions, Fig. 9. A three-digit switch is provided for setting the component percentage. A five-tube Nixie readout displays the total quantity of a component in a blend.

The console consists of a center panel and two wing panels as shown in Fig. 6. The center panel contains indicating and alarm lights that duplicate those on the control panels. Lights for each panel are arranged vertically with functions displayed horizontally. The master controls for the two blenders are contained in the wing panels. These controls include blend-rate set and blender start - and - stop switches. Total blend flow-rate and quantity indicators are also included on these panels.

TEL Handling System

Considerable modification was required to adapt the conventional TEL weigh - tank facility, located adjacent to the blender control center, to the new operation. With in-line blending, it was no longer possible to utilize a slipstream of stock while a batch was in progress to unload TEL from tank cars. Further, it was felt necessary to decrease the time required for unloading a tank car of TEL because the duties of the operator who performed the function were to be expanded to include the entire operation of the new blending plant.

The new TEL unloading system is designed to empty a 60,000-lb. tank car of TEL within 1 hour. To accomplish this, the 2-in. piping from the tank-car rack to the weigh tank was replaced with 3-in. piping. A new pump located in the blender area is used to circulate a stream from an additive solution tank through a new eductor to create the vacuum on the weigh tanks required to unload cars. A barometric loop is incorporated in the vacuum-line piping between the weigh tank and the unloading eductor, to prevent drawing TEL fluid into the circulating solution.

The metering and control equipment for continuously adding TEL to a blend is located on the floor of the weigh-tank pit. This provides a positive head of TEL through the meters thus avoiding cavitation problems. Fig. 5 shows the layout of TEL metering and control equipment.

Dye and additive handling. A new facility was constructed for preparing dye and additive solutions. As shown in Fig. 10, dry dyes and liquid additives are siphoned from barrels with a pump-eductor system, mixed in the piping, and pressured to any one of twelve 2,000-bbl. additive - solution storage tanks. Three identical eductor stations are provided, two for gasoline and one for midbarrel additives.

Each eductor is mounted in a novel manner between two swivel joints so that a maximum number of barrels may be unloaded with a

"Lining up a blend is very simple. The only operation in the field involves opening pump suction isolation valves on stocks and additives... Control of blend is excellent."

minimum of barrel handing. The operating floor is fabricated of open grating with a small basement for efficient house cleaning. The additive mixing system is shown in Fig. 11. The additive eductor pumps are located outside and are automatically controlled by set-stop meters.

Dye and additive solution strengths are adjusted to be compatible with the capacity of the additive metering stations. These stations can accurately meter flows ranging from 1 to 8 g.p.m. Dye and additive blend batches are for the most part set up to utilize multiples of whole barrels of concentrates, thus avoiding the necessity to weigh quantities added.

Testing and Calibrating

A complete and comprehensive check and calibration of the blender control equipment was needed before startup. The most notable reason was the difficulty of proving the volumetric accuracy of the system, once in operation, since most of the stocks are metered from running tanks.

In addition, the system in operation would have to be checked using valuable blend stocks and additives. A malfunction of equipment or a problem in design would be quite costly in time and materials.

An added inducement for a comprehensive check of the system was the necessity to switch operations from the existing batch system to the new in-line system without loss of blending capability. In other words the blender had to work right the first time.

A detailed testing and calibrating procedure, which required about 1 month to complete, was set up and followed. The procedure called for sequential testing, starting inside the control room and gradually working out into the field. The order of testing started with each wire, connection, light, etc., and ended with functional checks of pump start and shutdown circuits, field-mounted amplifiers, etc. The electric-transmission lines were tested not only for continuity but also loop resistance, noise pickup, signal attenuation, and insulation resistance.

This test work required use of temporary electrical jumpers to simulate operating conditions, and consequently did not represent a true and complete test of the system. The next test in the procedure was to disconnect each turbine meter and to insert an audio oscillator to simulate flow. With this test, each panel was subjected to all conceivable situations which the final system might encounter.

Since the turbine meters and associated pumps and control valves could not be proved without fluid flow, the final testing involved checking each meter against tank gages. This was done while adding stocks to gasoline batches made by the old process.

When all meter systems were proved within the guaranteed accuracy of $\pm 0.5\%$, the blender was ready for startup.

Blender Startup and Operation

From the day of startup on January 17, 1961, the blender has exceeded expectations.

Lining up a blend is very simple. The only operation in the field involves opening pump suction isolation valves on stocks and additives. Blender-control operations include switching on the desired panels, dialing the percentages, setting the blend rate, and pushing the start button. Smooth operation is achieved within 2 to 3 minutes after startup.

Control of the blend compositions has been excellent. The electronic-control equipment being digital has virtually absolute accuracy. Meter balances have been very good in nearly all cases. Material-balance data on a number of blends are shown in Table 2. These data, which are typical, show that the total of the individual stock and additive meters agrees closely with both the blend total meter and the amount obtained by gage of the receiving tank. The degree of control is also shown by laboratory data, Table 3, which were taken on both composite and spot samples during a blend of housebrand gasoline.

The addition of TEL continuously, rather than by a pulse or cyclic control has proved to be a real advantage in blender operation. Product samples taken from the blender booster pumps are used as a reliable basis for composition adjustments during the course of a blend. The operator has reduced the rate of TEL addition during several runs to trim the product knock ratings exactly to specifications. This has resulted in substantial savings in TEL costs.

Operating difficulties have been relatively minor. The usual screen-plugging problems forced shutdowns in a number of early blends. This problem, associated with new piping, has lessened with time. Slight modifications were required on the 6-in. turbine meters to open up clearances to insure a long life. Several electronic module cards failed in the early startup period. However, failures of electronic equipment have been exceptionally few.

Acknowledgment

Several people played key parts in the successful development of the continuous blender:

Robert M. Brown, general superintendent of operations at the Los Angeles refinery,

H. A. Alixopulos, project manager, and William Carmack, instrument engineer, of Fluor Corp., who played major roles in design, construction, and testing the equipment.

Martin Rubin, systems supervisor, Waugh Engineering Co., who supervised the development and construction of the metering and control equipment.

Charles Hill, project manager, Packard Bell Computer Corp., who developed circuitry and supervised construction of electronic-control equipment.

INSIDE COMPRESSOR HOUSE, nozzles (see circle) are in position to deluge the equipment in case of fire. Extinguisher unit discharges its dry powder at extremely high rates so that flame is smothered in minimum possible time.

CATC protects compressor with . . .

FIRE-EXTINGUISHER UNIT is simple, compact, and easily salvaged. Reels at right end are for hand hoses. Sphere on left end holds dry-chemical extinguisher. When unit is operated, sphere rotates to insure free-flowing powder. Material flows through pipe (arrow) to compressor house.

automatic dry chemical extinguisher to . . .

Fight fire on unmanned offshore platform

BY ED McGHEE
Drilling Editor

HOW TO PROTECT against fire on an offshore platform? There are any number of systems which might be satisfactory if the platform were manned at all times. The problem gets more complex when the structure is unattended. Most all conventional fire-fighting methods have drawbacks for such installations.

To meet this situation on one of its platform-mounted gas compressors, the CATC group of companies has adopted a new dry-chemicay system which has these advantages:

1. It has the effectiveness of all dry-chemical systems against petroleum fires.
2. It contains all its own power; no external pumps or other devices are necessary.
3. It has a "turnover" mechanism to guard against the tendency for powder to tamp down and be difficult to handle over a long period.
4. It is simple, compact, low in cost, and can be salvaged easily.
5. It delivers large volumes either through hand nozzles or automatically opened fixed nozzles.

Heart of the system is a large sphere which holds the dry chemical. This sphere is cradled on two bearings much as if it were a globe of the world lying on its side with north and south poles horizontal. When the chemical nozzles are opened, a small gas-operated mechanism turns the sphere 180°—so that the "globe" rotates about its poles and the point on the "equator" which was on the bottom comes to the top.

At the same time, stored nitrogen under high pressure is released into the sphere. Rotating the sphere and charging it have an important function. This action agitates and aerates the dry powder so that it becomes as "fluid" and free flowing as when first put into the sphere.

The same system has been used successfully on drilling barges, oil-well-fracturing jobs, and even simulated blowouts. It is a product of Fire Control Engineering Co., Fort Worth.

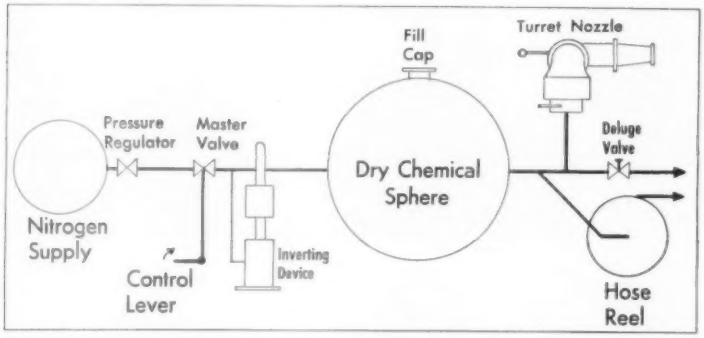
For platform. The platform be-

UNATTENDED OFFSHORE PLATFORM, CATC's 120-A off Vermilion Parish, Louisiana, needed simple fire-protection unit requiring no outside power. Here, the dry-chemical unit chosen is shown on the platform deck beside the compressor house it serves.

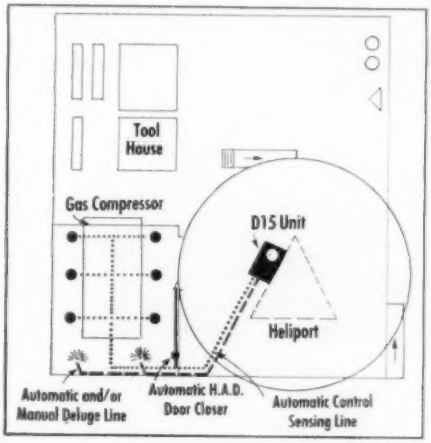
ing protected is operated offshore from Louisiana by the group of companies known as CATC and comprised of Continental Oil Co., Atlantic Refining Co., Cities Service Oil Co., and Tidewater Oil Co. There are no wells on the platform and no other major equipment besides the engine-driven gas compressor. The compressor is inside a small metal building, handling gas from a number of sources remote from the platform.

At several places in the compressor house, ordinary sprinkler heads have been installed over the compressor and gas piping. These sprinkler heads don't handle the dry-chemical stream; rather, they hold pilot air pressure for the main extinguisher. When heat (as from a fire) causes one of these sprinkler heads to open, the pilot air pressure bleeds off, causing the main extinguisher to start into action.

The dry chemical deluges the compressor house through two fixed nozzles situated to smother a fire anywhere in the building. Discharge rate of the unit is extremely high so that any fire will be extinguished in the minimum possible time. A total of 1,500 lb. of chemical is contained in the sphere.



COMPLETELY SELF-CONTAINED extinguisher system uses nitrogen gas for operation. When actuated, nitrogen turns sphere by means of small inverting device. Chemical can be turned through manual hoses or fixed nozzles.



WHEN HEAT OPENS ordinary sprinkler head, air pressure bleeds off and main extinguisher goes into action to douse fire.

BY W. L. NELSON, Technical Editor and Petroleum Consultant

Cost of lube rerun distillation operations

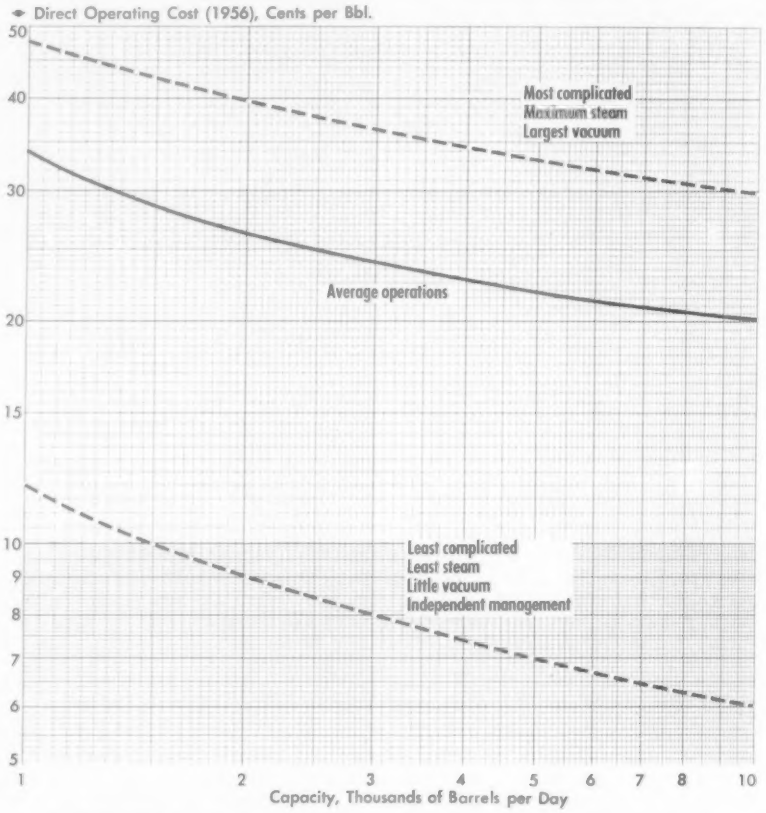
ALTHOUGH redistillation of lubricating-oil stocks to fractionate them into oils of different ranges has not been practiced widely since modern solvent treating and dewaxing processes have been employed, it is still often necessary to recover naphtha from bright stock and other solutions. Table 1 indicates the cost of solution-rerun operations in the size range of 1,000 to 10,000 bbl. per day of solution.

In those few instances in which pressed distillate or other straight-lube rerun operations are encountered, the costs of operating small topping systems may be taken as representative (Process Costimating No. 27, September 22, 1958, p. 113) except that less labor and more steam is used. This results in somewhat the following 1956 direct operating costs for small atmospheric steam rerun plants:

B/D	Cents/bbl.
1,000	15.0-19.3
2,000	10.9-15.2
4,000	8.1-12.4

Likewise, Fig. 1 indicates the direct operating costs of small vacuum units used for rerunning lubricating oils. The costs were built up as for the larger vacuum units of Process Costimating No. 39 (January 26, 1959, p. 221).

Rerunning operations conducted in old existing shell stills are usually somewhat cheaper than operations conducted in small continuous systems such as those considered in Fig. 1 and Table 1.



DIRECT OPERATING COSTS (1956) of vacuum lube rerun units. Fig. 1.

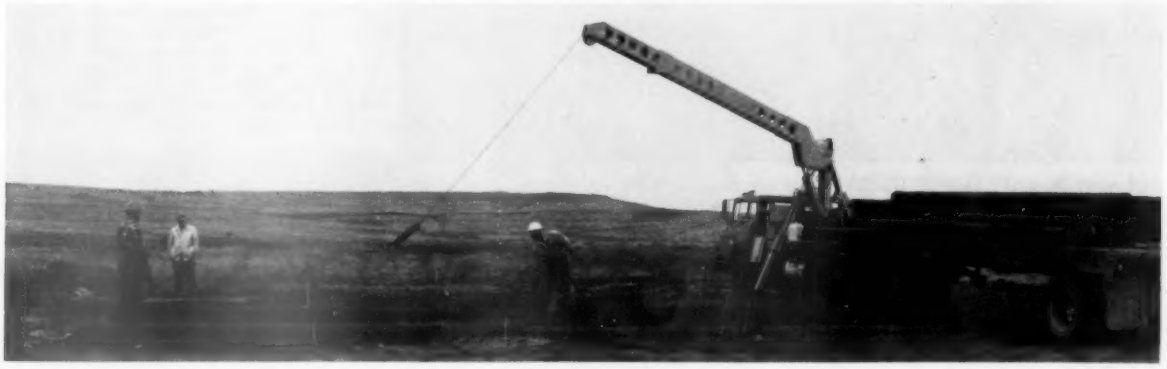
TABLE 1—ELEMENTS OF OPERATING COSTS—NAPHTHA SOLUTION RERUN

Element—	Unit (somewhat standard)	1956 Unit Cost	Cents per bbl. solution for these sizes of plants: 1,000 B/D	2,000 B/D	5,000 B/D	10,000 B/D
Labor—Supervision	0.1-0.5 men/8-hour shift	$3.85 per hour*	0.9-2.0	0.5-1	0.4-0.9	0.2-0.5
Operating	1-3 men/8-hour shift	$3.12 per hour*	7.5-15.0	3.8-7.5	1.7-5.0	0.8-2.25
Maintenance	1-3%/year of replacement	$67-141/daily bbl.	0.4-0.8	0.3-0.7	0.3-0.6	0.2-0.55
Fuel	80,000-100,000 B.t.u./bbl.†	20-40c/M.M. B.t.u.	1.6-4.0	Substantially constant		
Steam (process and burners)‡	30-80 lb./ bbl	45-60c/1,000 lb.	1.3-4.8	Substantially constant		
Power	0.002-0.006 b.hp.-hour/bbl.	5c/hp.-hour¶	0.24-0.72	Substantially constant		
Water	Two-thirds of heat generated	1.7c/250,000 B.t.u.	0.36-0.45	Substantially constant		
TOTAL DIRECT COST (probable extremes)			15-24	10-17	8-14	6-12
Obsolescence, ins., taxes, etc. (10% per year of replacement cost)			3.9	3.0	2.3	1.8
Laboratory overhead	0.1-0.3 men/shift		0.7-2.0	0.4-1.3	0.2-0.7	0.1-0.2
OTHER POSSIBLE INDIRECT CHARGES			5	4	3	2

*Average U.S.A. wages plus 27% for all burdens. †Heat generated. ‡Additional steam may be used for turbine pumps for part of the power shown below. Reuse to the extent of more than the 20% used here would reduce the steam cost. ¶Estimate of average of electrical (0.9 cent) and steam pumps (9 cents) per b.hp.-hr.

ONLY TWO MEN are needed to move a truckload of pipe now that Phillips Petroleum Corp. has the new rig shown here. Up to now the job would have required at least three men, and one more truck—one with a gin pole on it. This new rig not only cuts down on manpower and equipment, but it gets the job done faster. The unit can pick up pipe from beside the truck . . .

Remote-control crane speeds pipe handling for Phillips



. . . or move way out to snag a joint, using part of the boom's 27 ft. extended length and 180° of horizontal rotation. It is then hauled close to the truck, using power from two hydraulic pumps . . .

. . . where it is lifted on board. What makes this unit so versatile is the remote-control box strapped to the chest of the operator (inset). From his position on the ground, operator has complete charge of the crane, and still has a free hand to use on the guide rope. Control cable, normally coiled on truck, is long enough to give operator freedom in moving to any location within limit of the boom's operating area.

CAPACITY VARIES from 1,000 to 6,500 lb. depending on length of boom and angle of elevation. Boom will operate from below the horizontal to 70° above. Phillips has found many other uses for this rig, such as movement and placement of machinery. Unit can operate through the roof of a building, or over a fence to locate pumps, compressors, etc. where needed. Remote-control feature was designed by Phillips engineers.

MOMENT WHEN DAMAGE OCCURS very often is setting slips with pipe still moving downward. Result is crushing, bottlenecking, notching, and bending. Lightweight pipe is subject to such damage. Putting heavier walls on box end of joint, as in new dual-weight pipe, prevents such damage.

New dual-weight drill pipe turns in good performance

Pipe has thin walls over most of its length, but has thick walls near box end of the joint

BY ED McGHEE
Drilling Editor

DRILLING CONTRACTORS can now buy a drill pipe which has most of the advantages of the thin-wall pipe without many of its disadvantages.

The new pipe has thin wall sections through most of its length. However, the last 4 to 6 ft. on the box end is thicker. Result is that a string of the pipe is light but is not subject to the crushing, bottlenecking, notching, and bending in the slip area as is ordinary, lightweight drill pipe.

Cold drawing at the pipe mill produces a product which is, in effect, two weights of drill stem in one joint. The seamless steel tube has two distinct wall thicknesses and the transition section between the two is a gradual, uniform taper. Pittsburgh Steel Co. produces the new pipe which it calls "Dual Weight."

The company points out that thin-wall pipe is a means to help the driller in these ways:

1. Uprate rig-depth capacity.
2. Drill to the same depth with smaller rig and pumps.
3. Make faster round trips.
4. Cut pipe-trucking expense.
5. Improve hydraulics by means of larger internal diameter.

Pittsburgh believes its new pipe will have these advantages and still keep the same safety factor in slip area as regular-weight pipe. Currently the Dual Weight pipe is selling about 25% above regular drill pipe the same weight as the heavy end of the Dual Weight.

Several strings of the new pipe are already in use and its service has been entirely satisfactory to date.

UPRATING THE RIG as much as 15% is the claim made for the lighter-weight pipe. Not only is the new drill string lighter than conventional pipe, but it also is larger in diameter to improve hydraulics. This rig operates a 6,000-ft. string of the new pipe in West Texas.

"Depth capacity of rig uprated by about 15%"

Same as API outside. Externally, the new pipe's dimensions conform to API standards. Both ends are upset for API weld-on tool joints. The box end, the one most subject to damage from slips, tongs, and elevators, is heavier than the remainder of the joint. Not less than 4 ft. and not more than 6 ft. from the box end, the wall tapers to the lighter thickness.

Actually, the pipe is produced in more than the lightweight version. It also comes in a regular weight with an extra-heavy box end to give added strength for very deep drilling.

Sizes from 3½ to 4½-in. o.d. are available with either internal or external upset. Five-inch o.d. is available with internal or internal-external upset. Metal may be either Grade E or P-95.

To date, about 100,000 ft. of hole has been drilled with the new pipe. It has been used in many different areas in hard-rock drilling and soft. It has been used in wells as deep as 17,000 ft. It has been stuck in the hole, jarred on, and pulled free.

TABLE 1—DUAL-WEIGHT DRILL PIPE

Nominal Weight Per Foot Combination

O.D. (in.)	Wall (in.)	Nom. wt. per ft. (lb.)
3½	.330 x .254	12.50 x 9.50
3½	.368 x .296	13.50 x 11.00
3½	.449 x .368	15.50 x 13.30
4	.330 x .262	14.00 x 11.85
4	.406 x .330	17.00 x 14.00
4½	.337 x .254	16.60 x 13.25
4½	.337 x .271	16.60 x 13.75
4½	.406 x .337	19.10 x 16.60
5	.362 x .296	19.50 x 15.00
5	.437 x .362	22.30 x 19.50
5	.507 x .362	25.10 x 19.50

15,000-FT. STRING in South Louisiana improved hydraulics and lightened loads of deep drilling. On two wells drilled below 17,000 ft., this string was handled in normal fashion and showed no ill effects. After the jobs, the pipe was tested in tension and electronically inspected. No joints were found defective.

In all this drilling, the pipe has been run and handled in customary rig fashion. No special allowances have been made for it. There have been no unfavorable reports.

First test successful. The first Dual Weight pipe produced was only six joints of 4½-in.-diameter with walls 0.337 and 0.250 in. thick. This corresponds to 13.25-lb. pipe with a 16.60-lb. end. After drilling 47,000 ft. of hole, the box ends were marked in usual fashion by the slips. But there was no crushing or reduction in diameter.

The wall transition area proved durable and detect-free.

Next, a 6,000-ft. string was placed on a light rig. This string was made up of 4-in. pipe with 0.330 and 0.254-in walls, corresponding to 4-in. 11.85-lb. pipe with 14.00-lb. ends. At the end of 25,000 ft. of drilling, the pipe was in good condition.

Moreover, the drilling company estimated it had uprated depth-capacity of the rig by about 15%. Wear and tear on the rig had been reduced and fuel consumption was somewhat less.

On one occasion the string stuck in a key seat and was pulled on with 165,000 lb. Jarring freed the string but there was no evident damage to the drill pipe.

Two 4½-in. strings. The third string is 15,000 ft. of 4½-in. pipe with 0.337 and 0.271-in. walls, corresponding to 13.75-lb. pipe with 16.60-lb. ends. It has been used in each of two 15,000 ft. wells; only about 8,200 ft. of the total was drilled by the new pipe. There was a significant improvement in hydraulics as a result of the larger bore of the dual weight pipe.

After the two wells were completed, the string was tested in tension and electronically inspected. Every length exceeded the allowable minimum yield; no flaws were found by the electronic equipment.

A fourth string has been used on two fishing jobs while drilling 5,084 ft. of hole. On one occasion, there was a collar-connection failure; on another, a joint of regular drill pipe had parted. There were no ill effects on this 4½-in. 19.10-lb. by 16.60 lb. string.

35. How to estimate oil in place

by material balance for reservoir with initial gas cap

BY E. T. GUERRERO

GIVEN: Pressure, production, and fluid data for a reservoir as shown in columns 1 through 6 of Table 1. Other data on this pool are as follows:

p_i = initial reservoir pressure = 2,920 psia.

N = initial oil in place, st.-tk. bbl. = 223×10^6 (from volumetric calculations).

V_g = original reservoir pore vol. occupied by gas = 46.4×10^6 bbl.

T_r = reservoir temperature, °F. = 211.

B_{oi} = initial oil formation vol. factor = 1.454.

W_e = cumulative water influx assumed negligible.

FIND: Original oil in place by material balance.

METHOD OF SOLUTION: This equation, representing all changes in reservoir fluid content will be used:

$$N = \frac{N_p\,[B_t + B_g\,(R_p - R_{si})] + W_p}{\{B_t - B_{oi} + M_i\,B_{oi}\,[(B_g/B_{gi}) - 1]\}} \qquad (1)$$

Where:

p_i, N, B_{oi} are defined above.

N_p = cum. oil production, st.-tk. bbl.

B_t = two-phase formation vol. factor, res. bbl. per st.-tk. bbl.

B_g = gas formation-vol. factor, res. bbl. per s.c.f.

R_p = cum. gas-oil ratio, s.c.f. per st.-tk. bbl.

R_{si} = initial solution gas-oil ratio, s.c.f. per st.-tk. bbl.

R_I = producing or instantaneous gas-oil ratio, s.c.f. per st.-tk. bbl.

W_p = cum. water production, bbl.

B_{oi} = initial oil formation - vol. factor, res. bbl. per st.-tk. bbl.

M_i = ratio of initial pore space occupied by free gas to pore space occupied by oil.

B_{gi} = initial gas formation - vol. factor, res. bbl. per s.c.f.

G_p = cum. gas production, s.c.f.

ΔN_p = oil produced in a pressure interval, st.-tk. bbl.

ΔW_p = water produced in a pressure interval, bbl.

f_w = water cut, fraction of total liquid production.

SOLUTION: Columns 7-11 of Table 1 show the solution of the cumulative gas-oil ratio, R_p, or:

$$R_p = \frac{G_p}{N_p} = \frac{\Sigma\,\Delta N_p\,R_{I(av)}}{N_p}$$

$$= \frac{\sum_{i=1}^{i=j} (\Delta N_p)_i\,[(R_{I(n)} + R_{I(n-1)})/2]_i}{N_p} \qquad (2)$$

Thus for a pressure of 2,300 psia.:

$$R_p = \frac{\frac{770 + 1{,}150}{2}(4.1) + \frac{1{,}150 + 1{,}885}{2}(4.2) + \frac{1{,}885 + 2{,}670}{2}(4.4)}{12.7}$$

$$= [(960)\,(4.1) + (1{,}518)\,(4.2) + (2{,}278)\,(4.4)] \div 12.7 = 1{,}601$$

Cumulative gas production has been found from oil production and average gas-oil ratios. This can also be obtained by direct measurement of separator and stock-tank gas.

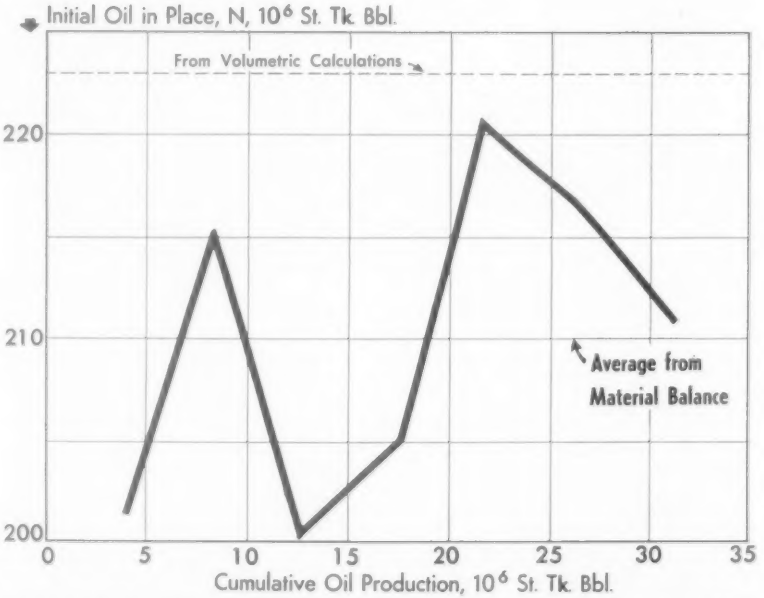
Columns 12-15 show the solution for cumulative water production, W_p, based on average water cut, f_w, values:

$$W_p = \Sigma\,\Delta W_p$$

$$= \sum_{i=1}^{i=n} \left[\frac{f_{wav} \times \Delta N_p}{1 - f_{wav}}\right]_i \qquad (3)$$

for a pressure of 2,300 psia.:

(Turn to Page 103.)



OIL-IN-PLACE VALUES found by material balance show some variation at different periods in the productive life of the reservoir. Fig. 1.

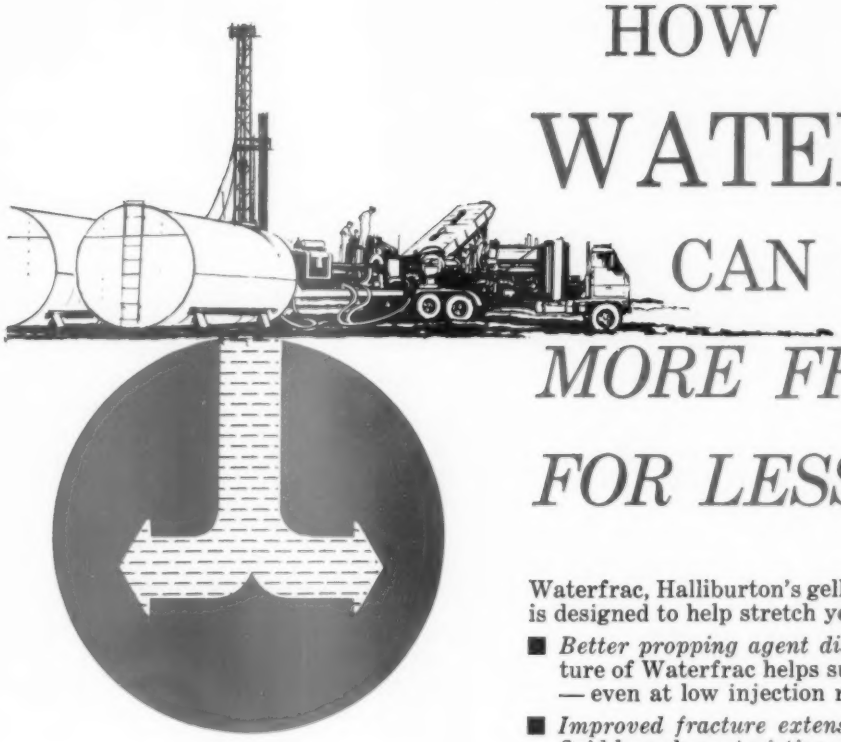


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Table 1—Basic Data and Solution of Material-Balance Equation for Initial Oil in Place

(1) Pressure, p, psia.	(2) Producing gas-oil ratio, s.c.f. per st.-tk. bbl.	(3) Cum. oil prod., N_p, M.M. st.-tk. bbl.	(4) Two-phase FVF, B_t	(5) Water cut, per cent f_w	(6) Gas FVF, $B_g \times 10^3$ reservoir bbl. per s.c.f.	(7) Oil produced in pres. interval, $\Delta N_p = (3)_n - (3)_{n-1}$ M.M. st.-tk. bbl.
2,920	770	0	1.454	0	0.954	...
2,740	1,150	4.1	1.477	0.6	1.004	4.1
2,560	1,885	8.3	1.506	4.7	1.072	4.2
2,300	2,670	12.7	1.565	7.3	1.194	4.4
2,050	3,713	17.1	1.648	8.0	1.347	4.4
1,800	4,480	21.7	1.757	6.7	1.550	4.6
1,500	4,320	26.3	1.956	7.2	1.905	4.6
1,220	4,020	31.2	2.276	11.0	2.390	4.9

(8) Avg. prod. gas-oil ratio, cu. ft. per st.-tk. bbl. $\frac{(2)_n + (2)_{n-1}}{2}$	(9) Gas prod. in pres. interval, M.M.s.c.f. (7) × (8)	(10) Cum. gas prod., M.M.s.c.f. Σ (9)	(11) Cum. gas-oil ratio, R_p (10)/(3)	(12) Average water cut fraction, f_{wav}	(13) (7) × (12) 10^6 bbl.	(14) Water prod. in pres. interval, 10^6 bbl. $\frac{(13)}{1 - (12)}$
...	...	...	...	...	...	...
960	3,936	3,936	960	0.0030	0.0123	0.0123
1,518	6,376	10,312	1,242	0.0265	0.1113	0.1143
2,278	10,023	20,335	1,601	0.0600	0.2640	0.2809
3,192	14,045	34,380	2,011	0.0765	0.3366	0.3645
4,097	18,846	53,226	2,453	0.0735	0.3381	0.3649
4,400	20,240	73,466	2,793	0.0695	0.3197	0.3436
4,170	20,433	93,899	3,010	0.0910	0.4459	0.4905

(15) Cum. water prod., 10^6 bbl.	(16) $R_p - R_{si}$ (11) − 780 s.c.f./st.-tk. bbl.	(17) $B_g \times$ (16), res. bbl. per st.-tk. bbl.	(18) $B_t +$ (17), res. bbl. per st.-tk. bbl.	(19) $N_p \times$ (18), 10^6 res. bbl.	(20) (19) + W_p (19) + (15), 10^6 res. bbl.	(21) $B_t - B_{ti}$ (14) − 1.454
...	...	...	...	...	...	...
0.0123	180	0.181	1.658	6.798	6.810	0.023
0.1266	462	0.495	2.001	16.608	16.735	0.052
0.4075	821	0.980	2.545	32.322	32.730	0.111
0.7720	1,231	1.658	3.306	56.533	57.305	0.194
1.1369	1,673	2.593	4.350	94.395	95.532	0.303
1.4805	2,013	3.835	5.791	152.303	153.784	0.502
1.9710	2,230	5.330	7.606	237.307	239.278	0.822

(22) $B_g \div B_{gi}$ (6) ÷ 0.954	(23) $\frac{B_g}{B_{gi}} - 1$	(24) (23) $B_{oi} M_j$ (23) (0.208)	(25) (21) + (24)	(26) Initial oil in place, N, 10^6 st.-tk. bbl. (20) ÷ (25)
1.000	...	...	...	...
1.052	0.052	0.01082	0.03382	201.4
1.124	0.124	0.02579	0.07779	215.1
1.252	0.252	0.05242	0.16342	200.3
1.412	0.412	0.08570	0.27970	204.9
1.625	0.625	0.13000	0.43300	220.6
1.997	0.997	0.20738	0.70938	216.8
2.505	1.505	0.31304	1.13504	210.8
			Average	210.0

$$W_p = \left[\frac{\frac{0 + 0.006}{2}(4.1)}{1.0 - (0 + 0.006)/2} + \frac{\frac{0.006 + 0.047}{2}(4.2)}{1.0 - (0.006 + 0.047)/2} + \frac{\frac{0.047 + 0.073}{2}(4.4)}{1.0 - (0.047 + 0.073)/2} \right] 10^6 = 407{,}500 \text{ bbl.}$$

Columns 16-26 represent solutions of Equation 1. For a pressure of 2,300 psia.

$$N = \frac{(12.7)(10^6)[1.565 + 0.001194(1{,}601 - 780)] + 407{,}500}{\{(1.565 - 1.454) + (0.143)(1.454)[(0.001194/0.000954) - 1]\}}$$

$$= 200.3 \times 10^6 \text{ st.-tk. bbl.}$$

$$\text{Where } M_i = \frac{V_g}{NB_{oi}} = \frac{46.4 \times 10^6}{(223 \times 10^6)(1.454)} = 0.143$$

DISCUSSION: This problem shows how material - balance calculations are used to find initial oil in place for a reservoir with an initial gas cap. Since a volumetric estimate of the initial oil in place is known, the results serve as a check.

A question arises as to which estimate is more reliable, the volumetric (pore volume) estimate or that found by material balance. The former is better known and is more widely used. But the latter is now accepted and often used when needed data are available.

The assumptions involved in each method have been mentioned before.[1,2] For depletion - type reservoirs, it is felt that both methods can give reliable results. The accuracy of the answers obtained will, of course, depend on the reliability and sufficiency of the data. A careful review of the assumptions involved show that even under favorable conditions, errors of 15 to 20% in the final results are possible by either method.

For a reservoir initially containing a gas cap the volumetric estimate of original oil in place is usually more reliable than that obtained by material balance. To apply the latter approach the size of the gas cap must be known.[3] It is normally obtained by the volumetric method. Such a reservoir will produce under a combined drive of solution gas and gas - cap expansion assuming gravity effects and water influx are negligible as in the case used for this problem. Where the amount of pore volume occupied initially by gas is about one-half of more of that occupied by oil (M_i), the energy contribution by the gas cap becomes significant compared to that of the solution gas (Columns 21 and 24 of Table 1). This statement does not hold true in this problem because $M_i = 0.143$. However, when M_i is about 0.5 or greater, errors in average reservoir pressure of 25 to 50 psi. (which are quite possible) can cause appreciable error in N due to over or underexpansion of the gas cap. This expansion is directly proportional to pressure and thus largely affected by error in this factor.

Note that in the solution of the problem, water production is included but water influx neglected. The latter was assumed negligible. If this assumption is wrong, then the computed values for initial oil in place are high. Fig. 1 shows the variation of computed initial oil in place values with cumulative oil production. The values vary between 200 and 220 million with the average being 210 million. This compares fairly well with the known volumetric estimate of 223 million stock-tank barrels.

References

1. Guerrero, E. T., and Stewart, F. M.: Problem 32, The Oil and Gas Journal, Feb. 13, 1961, p. 89.

2. Guerrero, E. T., Problem 34, The Oil and Gas Journal, Mar. 13, 1961, p. —.

3. Muskat, M.: "Physical Principles of Oil Production": McGraw-Hill Publishing Co., first edition (1949), p. 385.

BOOK

ESSAYS ON PETROLEUM CONSERVATION REGULATION. Edited by Wallace F. Lovejoy, and I. James Pikl, Jr. Published by Department of Economics, Southern Methodist University, Dallas 22. 116 pp. $1.50.

This volume is a compilation of papers delivered before a research seminar which met during the spring semester of 1960, and which was organized with petroleum-conservation regulation for its unifying theme.

The faculty recognized the importance of the industry and was conscious of the fact that single-volume analyses of this industry and its regulatory problems seldom present both sides of controversial issues. Then, too, the subject was a timely one, emphasized by the fact that pricing, production, and distributional practices of the industry were being scrutinized closely in the spring of 1960, both within and outside of oil circles.

OFFICIAL REGISTRY OF INDUSTRIAL RADIO SYSTEMS. Published by Communication Engineering Book Co., Radio Hill, Monterey, Mass. 244 pp. $5.

This registry lists more than 30,000 fixed transmitters. It contains complete information for determining the location and mail address of fixed transmitters on the same and adjacent frequencies within 75 miles of a new transmitter for which an application is to be filed.

One section is devoted to petroleum and pipeline licensees. The second part of the volume is a listing by frequencies.

APPLIED THERMODYNAMICS. By Stanley H. Bransom. Published by D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, N. J. 230 pp. $6.

This text provides a complete undergraduate course in thermodynamics, introducing the thermodynamic functions in logical order from first principles and discussing the application of those functions and principles to the basic operations of physical chemistry, chemical and fuel technology, and heat-engineering. The discussions of concepts, of the inter-relationships of the functions and of the applications, are simple and to the point, consistent with accuracy and clarity. Special care has been devoted to those points of concept and functions which students often find difficult to grasp.

The application of thermodynamics to process design and operation is a relatively modern development and the author discusses the relevance of recent developments in a number of fields—the handling of fluids at high temperatures and pressures, jet and nozzle flow, high trajectory flight, low temperature, and gas liquefaction.

A STUDY OF THE EFFECT OF THE CURTAILMENT OF PRODUCTION ON OIL RECOVERY FROM WATER FLOODS AND OTHER SECONDARY-RECOVERY PROJECTS. Published by the Interstate Oil Compact Commission, P. O. Box 3127, Oklahoma City 5, 122 pp.

In summary, the report states that the curtailment of water floods and other secondary-recovery projects is chiefly an economic problem rather than a physical one.

While the maximum amount of oil possible of recovery from a homogeneous reservoir-as-a-whole by induced water floods or by advance of a natural water drive is not effected greatly by the rate of recovery within the range of flooding rates normally encountered, the effect of curtailment on the economics may make the operation unprofitable before all of the oil has been recovered.

Prime movers: Electric-motor drive

BY JOSEPH ZABA

ELECTRIC-MOTOR drive for a pumping installation offers many advantages over internal-combustion engines. Initial and maintenance costs are low. Life expectancy and salvage values are high. Only a minimum of attention is needed. Down time, with the resulting loss or deferring of well's production, is quite low.

Motor drive possesses three characteristics which are particularly conducive to efficient pumping operations: (1) the amount of power used can be easily determined, permitting calculation of costs and efficiencies; (2) counter-balance conditions of the pumping unit can be conveniently determined without interfering with the well's operation, and (3) because of ease of control over starting and stopping, electric motors are well adapted to automatic operation. This characteristic is becoming of increasing importance in view of the present trend toward automatic operation of oil-producing leases.

The main disadvantage of electric motors is the high cost of power under some conditions. This could be the case if large amounts of fluid are to be pumped, requiring large-size motors. The question of power cost is affected by so many factors that each individual case must be carefully analyzed.

Motor types used. The alternating-current, induction squirrel-cage type, 1,200 r.p.m. synchronous-speed, 440-volts, 3-phase 60-cycle electric motors are most generally used for oil-well pumping. Within this general classification certain designs have been nearly universally accepted because their characteristics meet the requirements peculiar to the application.

In starting, which is frequently unattended, the initial inertia of the system must be overcome. This inertia, which is inherently high, may be increased by high viscosity of the pumped fluid or by low ambient temperatures. Therefore, a motor with a high starting torque is needed. The loads are cyclic in nature. This, in addition to proper rating requires proper slip and thermal characteristics. The slip of a motor, expressed as per cent, defines the decrease in speed of the motor from the no-load speed to the speed with the connected full load.

Finally, motors for this use operate in the open, exposed to the elements, requiring a suitable motor enclosure.

NEMA (National Electrical Manufacturers Association) Design C and D motors have, to a large extent, proper speed-torque characteristics, Fig. 48. The NEMA Design C motor has a high starting torque, low starting current. Slip of the motor at full-load torque is around 3%. Its speed characteristics are rather rigid. As load is increased within each pumping cycle the speed of the motor decreases very little, increasing the demand on the electric-power supply system. These motors are economical, readily available, and their characteristics meet the requirements of oil-well-pumping service except under most severe climatic conditions.

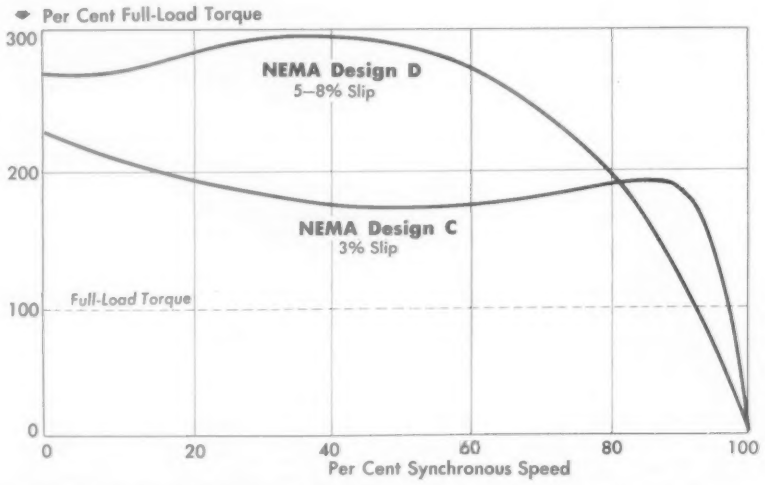
Design D motors are of the high starting torque, low starting current, high or medium-high slip type. Those with medium-high slip, 4 to 8% at full-load torque, are used in oil-well-pumping service. As the load increases within each pumping cycle, the motor slows down, depending on the inertia of the pumping system to carry the peak load. The energy is restored to the system when the load is reduced and the motor speeds up. This results in reduction of power peaks to the motor.

Design D motors are used primarily in cases when it is important to keep power peaks down. This, for instance, would be the case of fields served by a small generating plant or wells handling large volumes of fluid. Design D motors are slightly less efficient and more expensive than Design C motors.

NEMA standards classify the motors also according to enclosures, temperature rise, and insulation. Enclosures used in oil-well pumping are dripproof, splashproof, or totally enclosed fan-cooled. There has been considerable improvement in the design of dripproof enclosures. They have become more popular in the last year or so since pumping-unit design permits elevated mounting of the motors. This protects them from drifting sand and snow.

Dripproof motors have a service factor of 1.15. That means that the motors can be operated at 15% overload without overheating.

Splashproof enclosures protect the



APPROXIMATE SPEED-TORQUE CHARACTERISTICS of commonly used oil-well pumping motors. Fig. 48.

motors from liquid or solid particles falling on them from an angle of less than 100° from the vertical. Splashproof motors have a service factor of 1.0. They are not as commonly used as dripproof motors.

Totally enclosed fan-cooled motors are used only in special cases of highly corrosive, humid or dusty atmospheres. They also have a service factor of 1.0.

During the last 4 or 5 years electrical manufacturers have built motors especially designed for oil-field pumping. They are of the high-torque, low-starting current type. Slip ranges from 5 to 7.5%. Therefore, they do not exactly meet NEMA standards for Design D motors. They have a service factor of 1.15 and most of them are less expensive than NEMA Design C motors.

It should be noted that motors with characteristics other than those outlined above are also applied in oil-well pumping. For instance, motors with synchronous speed other than 1,200 r.p.m. are used. Single-phase motors are used primarily in small sizes where no three-phase power is available. However, use of single-phase power for pumping service, either directly or by conversion to three-phase power, is not always efficient or economical.

Motor rating. Induction motors operating on cyclic loadings have higher thermal losses than those subjected to steady loads. This is because with cyclic loads the thermal current exceeds the average current, due to the high peak currents drawn by the motor. Because of this fact a derating factor, sometimes referred to as the "cyclic factor," is applied in determining the nameplate rating of the motor for given motor-shaft power requirements of a pumping installation. Much has been written on this subject and there are some differences of opinion regarding this factor. A method has been suggested for determining this factor under operating conditions.[1] In general, the factors range from 0.55 to 0.75 depending on type of motor and its service factor.

From the standpoint of thermal capacity alone a higher thermal factor could be used with a dripproof motor, (service factor = 1.15) than with the splashproof motor (service factor = 1.0). Also, a higher factor would be justified for Design D than Design C because of high current peaks of the latter. It must be remembered, however, that the motor for beam-pumping service must be selected not only on the basis of its themal capacity, but also on the basis of its other characteristics discussed above.

With the cyclic factor selected, the nameplate rating of the motor would be:

$$N = \frac{P}{K} \qquad (1)$$

Where:

N = nameplate rating, hp.
P = power required at the motor shaft, hp.
K = cyclic factor.

With the nameplate rating determined, the next-higher-size commercially available motor would be used.

It should be noted that some users also apply to the motor a derating factor for lact of flywheel inertia of the motor, similar to the one used for multi-cylinder engines (Part 38).

Capacitors. An induction motor receives its excitation current from the electric system. The line current is composed of power current, which performs the actual work, and the excitation current. The ratio of the power current to the line current or of the "real power" to the "apparent power" is called the power factor. Correction of power factor consists, essentially, of supplying the excitation current to the motor, thus relieving the power source of the need to furnish this current.

The power factor of beam-pumping installations is inherently low because the motors operate usually at 60 to 70% of their rating. The power-factor correction is by means of capacitors, provided usually at the individual motor installations. The use of capacitors is particularly advantageous if the power-factor clause is enforced by the power supplier. Other advantages of capacitors are reduction of power consumption and cost and maintaining of a higher voltage level at the motor, with the resulting improvement in motor's operation.

Grounding. Since grounding rods are of questionable value in many oil-producing areas there has been a trend in recent years toward grounding to the well casing. API RP 11H "API Recommended Practice for Electrical Surface Pumping Equipment," January 1959 edition, recognizes this practice pointing out the need for positive connection of the ground conductor to the casing head in a manner which would protect the connection from being disturbed during well servicing and would make it accessible for inspection.

High voltage. Voltage above the usual 440-880 level has gained popularity in the last few years. The most popular of these systems is the 762-volt level. High-voltage economy comes from use of smaller components in the system, such as conductors and controls, and from lowered heat losses. The disadvantage is that generally recognized electrical standards set the rating of the "low-voltage equipment" at 600-volt a.c. and that this rating is exceeded when 762-volt power is used.

The above-mentioned RP 11-H recommends the use of 762 volts for large fields with wide well spacing and heavy loads. It points out that installation should be under supervision of an experienced electrical engineer and that equipment, built by a reputable manufacturer, should have a nameplate stating that it is suitable for 762-volt operation with components installed according to the national electrical code.

Reference

1. H. M. Halderson; "How to Determine Actual Power Output and Derating Factor": World Oil, November 1958—an article based on a paper presented at the Petroleum Industry Conference of AIEE, Dallas, September 1958.

Coming:

Annual Report on Natural-Gas Storage Capacity

NEXT WEEK, The Oil and Gas Journal will present an up-to-date report on underground natural-gas storage capacity.

The Journal's seventh annual survey includes a company-by-company listing of all such facilities, including new projects under way or planned.

Figures are broken down into working-gas capacity and cushion gas.

For the first time, the report will include a survey of Canadian gas storage capacity.

Watch for this significant report in the May 8 issue.

PIPELINE REPORT

. . . Selected papers presented at the API Division of Transportation pipeline conference, St. Louis, April 26-28.

Economy and safety make

Underground storage ideal for LPG

Here are the conclusions of more than 50 operators of underground storage on the three types available. Comparisons cover safety, pumping costs, and losses.

BY G. P. JENNINGS
Phillips Pipe Line Co.

BECAUSE of its relatively low construction cost and safety, underground storage is ideal for LPG and other high-vapor-pressure products.

Operating problems and costs incurred in mined and salt-dome caverns appear to be very nominal. This is particularly true when the large storage volumes they usually provide are considered.

In some cases operating costs and problems are greater than those found in pressure storage. Salt-bed caverns frequently present some costly operating problems but, in most cases, the high operating costs can be justified by the low initial costs.

These conclusions are the consensus of more than 50 operators of underground storage, not those of only the author or his company.

Although underground storage of propane and butane is by far the most common, other high-vapor-pressure products stored are ethylene, propylene, natural-gas-liquids mix, olefin feed stock, isobutane, and butylenes. Gasoline and furnace oil are also stored underground by some companies. Since propane and butane are the most common products stored in this manner, all comments apply to these products unless stated otherwise.

There are three types of underground caverns:

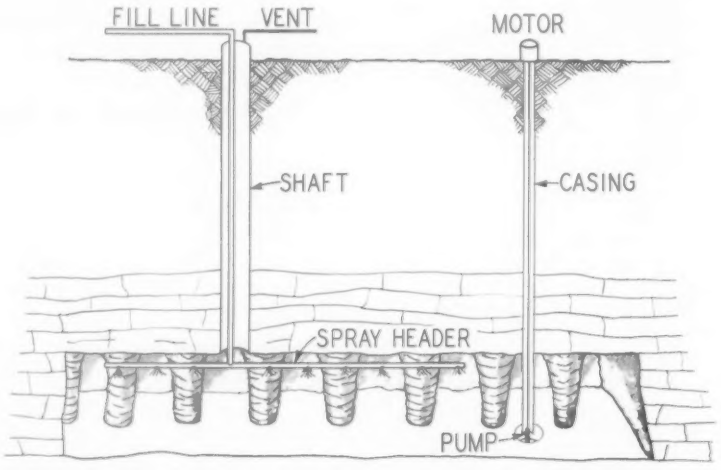
1. Conventionally mined caverns in impervious rock.
2. Solution-mined cavern in salt dome.
3. Solution-mined cavern in salt bed.

The mined caverns and the salt domes present only the usual operating problems. The salt bed, however, is often a problem.

Mined Caverns

The mined cavern is constructed by mining the cavity from shale or rock. The depths usually range from 250 to 400 ft. below the surface. The mine shaft is sealed and one or more vents or fill pipes are installed. The older caverns are filled through a fill pipe which may extend to near the bottom or simply through the roof.

Either way, the compression of the vapor space, as the liquid level rises, generates heat and pressure which is, of course, undesirable. It is, therefore, occasionally necessary



MINED CAVERNS are usually from 250 to 400 ft. below the surface. Losses are low, generally not more than 1%.

Presented at 1961 API Pipeline Conference.

to use a compressor to withdraw vapors, compress, condense and return the liquid to the cavern. The newer caverns are filled through spray headers suspended near the ceiling. This effectively reduces cavern pressures during fill.

Without spray filling, light ends, principally ethane, tend to build up in the vapor space and occasionally must be removed either by venting and burning or withdrawn by a compressor and condensed as mentioned above.

If off-specification product is delivered to the cavern, this product will stratify and will not mix with the other product in the cavern. Adequate circulation facilities usually are not provided to blend the mixture.

Conventional pumps. Since the cavern depth is not over about 400 ft., more or less conventional deep-well pumps are used to empty the cavern. They are about as trouble-free as one would expect for this type of pump running in liquids with little lubrication effect provided by propane and butane. One company uses a submersible pump and motor and also a deep-well pump, both of which give acceptable performance. Some discharge the liquid from the cavern direct to loading operations. Others pump into a surge tank on the surface and then use a conventional pump to loading operations.

Some companies empty the cavern by using compressors which pull vapors from the vapor space of a surge tank on the surface and reinject the vapors into the cavern. The liquid is thus pressure-lifted into the surge tank and pumped off to loading operations with a conventional pump. This method has the advantage of no moving equipment in the cavern but has the disadvantage of higher power costs.

Gaging of the contents is usually accomplished with a float-type level indicator. Other devices such as a differential pressure-type level indicator are also used as a check on the float gage. Since caverns have an irregular shape, it is necessary to correlate the volume in the cavern with the gage reading. This is usually done with an orifice or positive-displacement meter measuring the product in or out of the cavern.

The maximum permissible operating pressure is established by following the Natural Gasoline Association of America tentative standard. The cavern is thenceforth protected from overpressure by relief valves and pressure-monitoring equipment.

Losses are quite low, apparently 1% or less.

Salt-Dome Caverns

There are more than 200 salt domes in the Gulf Coast region from the Mexican border to western Alabama. These domes range in size from ½ to 7 miles in diameter. The depth to the top of the salt is from 500 to 1,000 ft. and the average thickness is over 10,000 ft. and in many cases as deep as 30,000 ft.

The salt-dome cavern is constructed by first drilling the hole into the salt formation, casing, and running the protective string and tubing by conventional drilling methods. Fresh water usually is injected down the tubing and salt water is removed up through the protective string. A hydrocarbon blanket is maintained above the bottom of the protective string and the protective string may be raised or lowered to control the shape of the cavern during the washing operation.

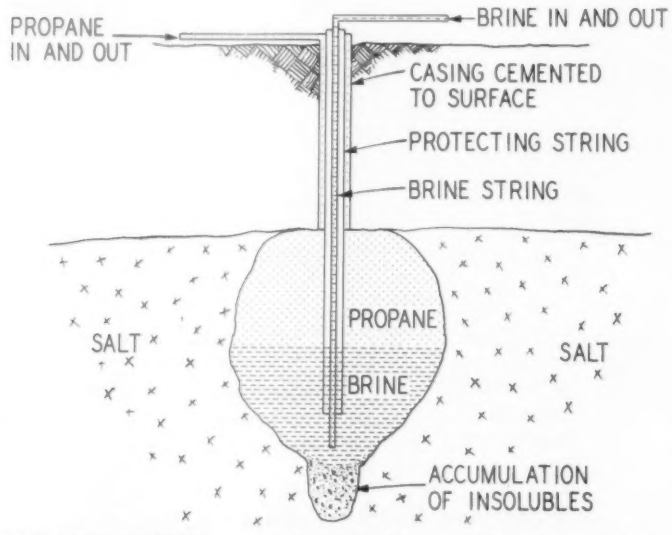
Upon completion the cavern is, of course, full of brine. Product is then forced down the casing and the brine is forced up through the tubing string. The protective string, as mentioned above, can be removed or left in the hole. In most cases the protective string is removed before operation in order to provide more flowing area and thus a faster flow rate for operations.

"Extreme line" casing is sometimes used to avoid couplings and thus improve the flow rate. It is also useful in combating joint corrosion.

The author . . .

G. P. JENNINGS

G. P. Jennings is general superintendent, Products Pipe Line System, Phillips Pipe Line Co. He has spent more than 20 years in pipeline operations. He joined Phillips in 1930 as a design engineer and transferred to pipelines in 1938. Since then he has successively been engineer, chief engineer and superintendent of operations. Mr. Jennings is a graduate of Rensselaer Polytechnic Institute. He spent several years with Worthington Corp. in the development of locomotive feed-water heaters and pumps.



SALT-DOME CAVERNS are usually from 500 to 1,000 ft. below surface. Operating problems are few and costs are low.

In an ethylene cavern, the protective string is often left in place and the bottom set at, say, 10 ft. above the bottom of the tubing string. Then as the cavern is nearly full of ethylene to the point where the brine level is depressed below the level of the protective string, ethylene will rise through the brine column in the protective string and thus give a large increase in pressure which is a warning that the cavern is practically full of ethylene.

Warning needed. Without this warning the filling would continue and further depress the brine level until ethylene entered the tubing string where it would rise to the top and thus drop the brine column. The tubing string would be full of ethylene at a high pressure. It might then be necessary to move in high-pressure brine pumps to reestablish the brine column in the tubing string.

As the brine is displaced during the filling operation, it is often saved for further use by storing in a brine tank or an open pit. If no storage is available, it is wasted. If stream polution is a problem, it frequently is wasted into a brine-disposal well. In some cases the brine-disposal well is at a shallow enough depth to permit economic recovery and further use of the brine. If the disposal well is quite deep, brine-lifting costs are prohibitive and it is not recovered.

Open brine-storage pits are sometimes constructed without a lining if the soil is suitable. Others are lined with asphalt plank, asphalt-paper sheeting, synthetic-rubber sheeting, polyethylene film, or gunite. One company has an open pit with a capacity of 1,200,000 bbl. A burn tank is sometimes located near the center of the pit where a pilot flame burns continually to ignite any escaping gas from well tubing failures or normal product carryover.

The cavern is emptied of product by returning brine to the cavern by gravity flow or by applying additional pressure if higher emptying rates are desired. However, brine is not always used for this operation. If a cavern is put in service before it has reached its desired capacity, fresh water is used to displace the product. In this way the size of the cavern is increased by about 15% for each complete cycle of filling and emptying.

Second cavern. Another variation of this enlargement process is to drill and start washing another cavern. Then pass the fresh water through the new cavern where it becomes brine and then into the cavern for displacing product where no further enlargement is desirable. From the above discussion it can be seen that whenever fresh water is used the total cavern capacity is becoming greater whether needed or not.

With the normal growth of business this increase of capacity is frequently desirable. However, if no further capacity is wanted, the only solution is to provide brine storage practically equal to the product storage capacity or to keep making brine caverns as previously mentioned. It is a question of economics on these two methods of providing brine.

One fairly common problem in salt-dome-cavern operation is the precipitation of salt in the brine string tubing. Salt domes have an earth temperature of up to 130° F. and the brine in the cavern becomes saturated at this temperature. Then when the 130° F. brine is raised up through the brine tubing string by the flow of much cooler product down through the casing. The brine is cooled below its saturation point and salt crystals deposit and either reduce or stop the flow.

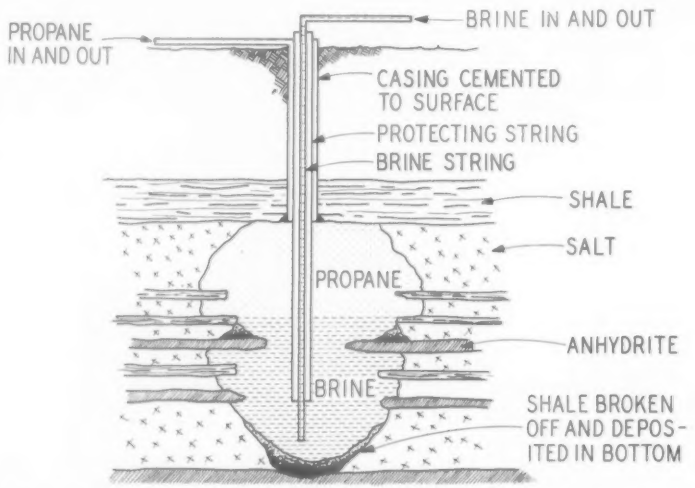
This problem is, however, easily solved by a fresh-water wash through the brine tubing string. This salt buildup also occurs at flow-restriction points such as pumps, throttling valves, christmas-tree ports, etc. Here again it can be easily removed by flushing these passages with fresh water.

Sand buildup. The anhydrite content of the salt sometimes creates insoluble "sand" buildup at the base of the cavity necessitating periodic raising of the tubing string to prevent plugging. This, of course, reduces the available cavern space. It is for this reason that it is commonplace, when the cavern is initially washed, to provide a sump or storage chamber in the bottom of the cavern to catch these insolubles.

The brine effluent from the cavern may contain abrasive materials (sand, dirt, and undissolved solids) which, depending on the amount, may tend to scour and erode steel at points of curvature if the velocity of flow is high. It has been recommended that consideration might be given to wall thickness of bends, tees and elbows in this operation.

Caverns in ethylene service have experienced tubing string leaks. This condition has been improved by the use of couplings with teflon ring inserts. Hydrates forming in the ethylene lines also cause some minor trouble.

Various means are used to provide fairly accurate cavern inventories. A Photon survey, when used in combination with a Sonar caliper, is reported to give accurate well inventories. Some meter the product



SALT-BED CAVERNS frequently have costly operating problems as shale edges shear off and damage tubing.

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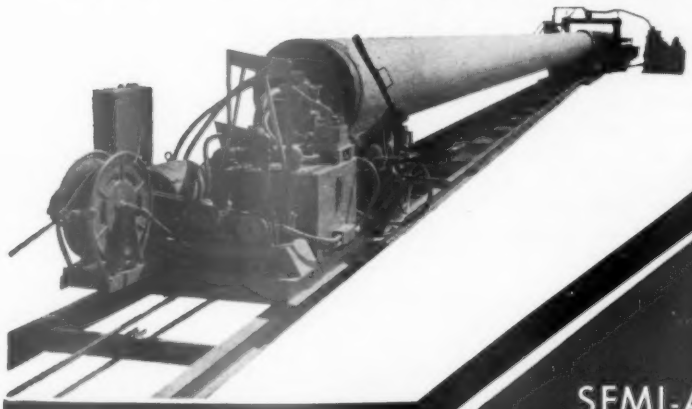

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in and out with orifice meters and others use positive - displacement meters. One company uses dual-flow positive - displacement meters with printer heads.

Salt-Bed Caverns

The salt - bed cavern is constructed in much the same manner as with salt domes. The operation is also practically identical; the brine is displaced during product filling and the brine is returned to the cavern to displace the product for removal. Fresh water, if used, of course, increases the size of the cavern and there is always the problem of brine disposal.

Precipitation of salt in the brine string tubing is not normally encountered as in salt domes because of the lower cavern temperatures in salt beds. However, some do have this trouble especially in extremely cold climates.

Nearly all salt beds have one big operational headache. The shale ledges slough off and shear or kink the tubing. The repair or replacement of this tubing string, of course, adds to the operating expense. If during the filling cycle the brine tubing string breaks off in the LPG space, above the brine level, the product will flow out the brine string tubing to the pond or other brine-storage space. This same problem can exist if the cavern is overfilled thus depressing the brine surface below the bottom of the tubing string.

Flare used. Several operators provide a flare in the pond to burn the product if it should escape, thus reducing the potential hazard. One company uses a rate-of-flow device which operates when the brine string is flowing propane at a higher rate of flow than is normal while flowing brine. At least one company uses a conductivity probe on the brine line which gives an audible alarm at the first indication of LPG in the brine leaving the cavern.

Some operators report that they avoid removal of the tubing string from the hole as it is often difficult, if not impossible, to replace it without it hanging up on the shale ledges. It is, therefore, occasionally the practice to sacrifice some of the available storage in a cavern because of the tubing trouble rather than risk the losing of the entire volume.

As shale stringers break off and fall to the bottom of the hole, it is necessary to raise the brine tubing string. Some of the available capacity of the cavern is thus lost. One operator has considered using a jetting tool that will remove the debris from the bottom of the cavern. One company reported that two caverns had washed together thus making one cavern of nearly 200,000 bbl. Another cavern developed a leak to the surface. It was then necessary to use only the top fourth of the cavern above the leak.

Inventory control. Cavern inventories are maintained in the same manner as with salt domes; Photon survey with a Sonar caliper, orifice meters, and p.d. meters.

One company storing deethanized gasoline uses natural gas at 1,000 psi. to displace, or that is, to remove the gasoline. When the cavern is filled with product the gas is pressured back into the gas pipeline. Gas absorption into the product has been a problem.

One company is in a unique position in that it is located close to a salt company. Arrangements are worked out so that the salt company will accept excess brine and when brine is needed they will supply the brine needed by the cavern for product displacement.

Nelson Refinery Cost Indexes

Published in the first issue each month in the Technology-Operation section.

Compiled by W. L. Nelson, Technical Editor and petroleum-refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis)

Explained on Page 101 of the issue of August 5, 1957

	1950	1954	1957	1958	1959	1960	Dec. 1960
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	228.3	228.6
Electrical machinery	134.9	160.0	188.9	192.7	195.8	195.2	193.1
Internal-comb. engines	126.0	150.5	173.9	178.3	178.5	180.7	180.0
Instruments	127.8	154.6	187.4	194.9	201.0	202.5	207.5
Heat exchangers	140.0	171.7	203.6	181.2	178.9	194.0	186.8
Misc. equipment average	*126.2	160.7	192.1	192.4	196.1	200.0	199.2
Materials component	149.5	174.6	201.9	204.2	207.8	207.6	207.2
Labor component	144.0	183.3	208.6	220.4	231.6	241.9	†245.8
Nelson construction index	146.2	179.8	205.9	213.9	222.1	228.2	230.4

*Used in computing the Nelson Index until April 1952. †Converting Labor Component to 60% skilled labor rather than 50:50. Transition will be complete by May 1961.

Refinery Operating Cost Indexes (1956 Basis)

Explained on Page 171 of the issue of June 1, 1959

	1946	1952	1954	1958	1959	1960	Nov. 1960
Fuel cost	49.6	81.0	86.5	102.1	103.5	109.9	112.9
Labor cost	73.1	88.7	90.9	105.0	102.3	100.3	100.0
Wages	52.4	81.5	88.7	105.4	111.5	113.0	113.1
Productivity	68.3	90.2	97.1	100.3	109.0	112.9	113.2
Investment, maint., etc.	51.2	83.6	92.0	109.5	113.7	116.9	117.4
Chemicals cost	37.0	72.1	85.7	104.4	107.8	114.3	115.5
Operating cost indexes:							
Refinery	58.5	80.5	88.7	105.8	106.8	108.8	110.0
Process units‡	62.9	82.2	88.4	105.8	106.0	107.2	108.5

‡Add separate index for chemicals, if any are used.

Tomorrow's pipelines will need fewer but abler employes in more demanding jobs

"And development is good that gets a job done easier, or faster, or at a lower cost. It is good because it releases those greatest of all resources—human ingenuity and devotion, and perseverance—to new efforts in new directions with the hope of still greater rewards. That is what we must do."

BY J. A. HORNER

NEARLY 100 YEARS AGO, in 1865, the oil industry was trying to become more efficient, so oil men built the first crude line, 2 in. in diameter and 5 miles long. It did its job, and petroleum pipelines have been doing a magnificent job ever since, helping the oil industry provide energy wherever and whenever it is needed.

And here we are, still concerned about becoming more efficient. It's a complex subject, even in its simplest form, so, to keep these remarks within bounds, I should like to concentrate on just three points.

First—the basic problem facing the oil industry and the responsibility of the pipeline segment for helping to solve it. That problem is to increase efficiency.

Second—the prospects for improving efficiency through better use of manpower.

Third—the impact of all this on people in the various segments of the pipeline industry.

Concerning the first point we can be brief. Costs have continued to increase. The oil business is not making the margin of profit it would like and should be making. The maneuvering room between income and outgo has become narrower.

Effects common. As things go in a risky and competitive business, pipelines are pretty well fixed. Why should we worry about problems

"AT SHELL we believe in home-grown management." Russ Huffman and J. R. McEntee, Shell Development Co., and G. G. Billings, Shell Pipe Line Corp., listen to J. G. Jordan, Shell Oil Co.'s marketing vice president during a Shell Management Course session at Columbia University's secluded Aren House, Harriman, N. Y.

"ELECTRONIC COMPUTERS . . . can provide more information than management has ever had, and they can provide it faster and in more useful forms." This is Shell Pipe Line's off-line computer installation used for data processing and optimization, hydraulic and cost control studies.

that are more severe elsewhere? Because the oil industry is essentially integrated. When one part gets pinched the other parts will in the long run be hurt.

By the same token, if we can improve our operations, we can help the other segments improve their competitive position—our shippers at one end of the line and their customers at the other.

And this brings us to our second point, the prospects for improved efficiency through better use of manpower.

We aren't making the best use of what we've got. As individuals, few of us come anywhere near performing at full capacity. Even in well-organized groups we may not do much better. It would seem worth while to try to help each individual realize more of his potential and to help groups work more effectively.

Fewer jobs. The trend in the pipeline industry is toward fewer jobs, but more productive jobs, therefore more demanding jobs — jobs that require men with more training.

When we start to think about personnel we customarily think first of our present employes. It is this group that we depend upon for our operations today and tomorrow. If we have made too many past mistakes personnel-wise—and few of us have not made our share—then we must identify these mistakes and either eliminate them or correct them.

So our first step should be to evaluate existing staff in the light of requirements for tomorrow's operations, on the basis of quantity as well as quality. Standards must be established, job specifications prescribed, aptitudes judged, operating manuals prepared, and an appraisal made in many cases of the ability of nontechnically trained personnel to achieve semitechnical skills. Likewise there is the requirement to establish our manpower needs 1, 5, or even 10 years ahead. This we must decide in the light of our plans for automation, contract maintenance, and our prospects for growth.

Having established the required skills and optimum manpower level, there will inevitably be the necessity to upgrade a significant segment of our personnel.

Inform employes. Certain requirements stand out in this field of training and development. Every employe is entitled to be informed, frankly and fairly, of management's appraisal of his performance and career potential and what will be expected of him to meet the demands of the future. Where formal training is required, cooperation between supervisor and employe must be achieved.

In staff evaluation, cases of inadequate performance will inevitably be encountered which we must face up to. We may be called upon to make some very hard decisions.

The question of staff complement for future operations offers no ready, easy solution. Each company must, in the light of its particular situation, determine what its requirements will be down the road and take appropriate action.

Although, fortunately for the pipeline industry, automation has been sufficiently evolutionary for attrition to take care of a good share of our problems, it has not been the answer in every case. There are ways that severance can be effected with a minimum of pain and suffering: severance payments, early pensions, employment aid, and other assistance. Despite these, the results are usually somewhat unpleasant to both management and the employe.

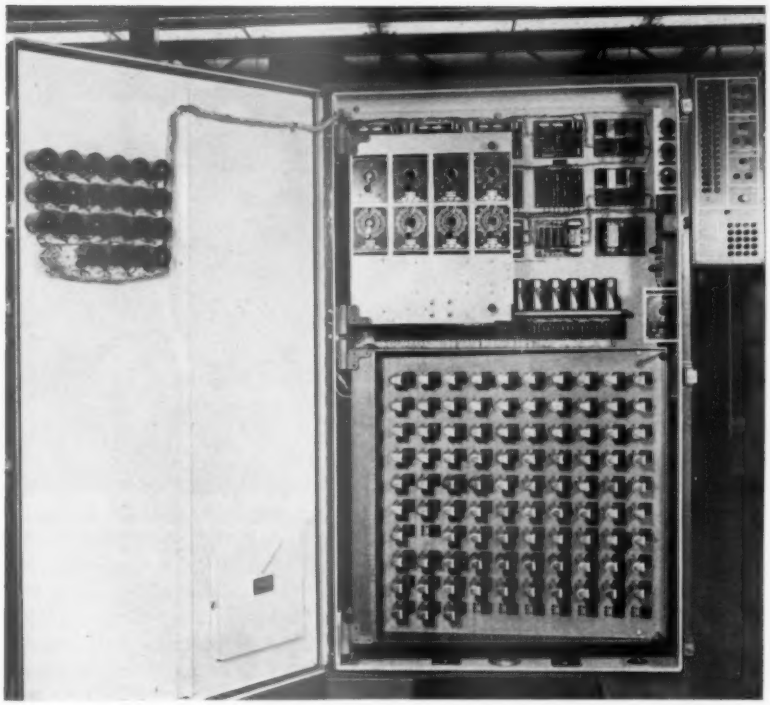
Trained personnel. For the more and more exacting jobs we can see ahead in the pipeline industry, recruiting of formally trained personnel probably is a major answer. Petroleum has become a relatively mature industry. It goes after new talent in competition with such glamorous things as electronics and space vehicles. If we want the best we can get, we must be prepared to offer competitive compensation at the start, and we must be able to promise opportunities for progress—and then deliver.

For our third point I want to discuss our future personnel re-

The author . . .

JACK A. HORNER

Jack A. Horner, president, Shell Pipe Line Corp., has been with Shell since graduating from Oklahoma University in 1936. He was with the legal department until 1944 when he became a member of a group planning Shell's postwar organization and expansion. He was made administrative assistant to the president in 1945, secretary of Shell in 1953, and vice president in charge of licensing for Shell Development Co. in 1955. He became president of Shell Pipe Line Corp. in 1960.



"WE CAN ANTICIPATE one day turning the job of scheduling, dispatching and line operation over to the computer . . ." This is the interior of the Shell-designed power-level controller. It automatically switches units, selects or adjusts operating levels. It can act before a manual operator would be aware of a malfunction.

quirements in more specific terms. Let's start with operations. Most routine operating functions are being performed remotely, or by local automatic controls, and the old three-shift station operator's job has all but disappeared. But this leaves us with a more critical job to fill: the attendant at a modern automatic station. He requires technical aptitude and sufficient skill to perform preventive and regular operating maintenance.

Modern station operation has left us with the problem of reassignment of surplus station operators. This should be approached with care, and may require aptitude tests, review of performance on previous jobs, and a search of records and personal interviews to ascertain latent skills.

Increasing the capabilities of our mechanical, electrical, and communications craftsmen is a definite must. The "bread and butter" personnel for continuous station operation must be qualified to attain a high standard of performance.

Precision needed. Most of our mechanical work requires considerable precision: mechanical seals and mechanical controls involve tolerances bordering on those used by a watchmaker.

In the electrical field, supervisory controls and electronic gear have introduced new items to the craftsman. Electronic control circuits are increasingly necessary for remote and automatic station operations. The electrical craftsman must constantly study to service new equipment.

In communications, linemen and wire-line technicians are being replaced by microwave technicians. Personnel who can learn and apply new skills are required. Data transmission requires an especially high reliability of communications, and this depends in a large measure on the abilities of technicians.

The growing tendency toward contracting of routine maintenance is imposing supervisory responsiblity on craftsmen and technicians. Not only must they be skilled in their field, but they must be capable of directing contractors. Another important requirement is the ability to instruct others.

Maintenance change. Pipeline maintenance has changed and will continue to do so. This will reduce the number and size of maintenance crews because of fewer leaks, improved transportation, chemical control of right of way vegetation, and less requirement for station relief.

Maintenance crew personnel must be selected with an eye for technical aptitude if they are to move into station-attendant, technician, and oil-measuring jobs.

Schedulers and dispatchers have already witnessed many changes, but more are in store. Some of the more obvious in this field which are already, or will soon be, commonplace are:

Use of computers to establish proper inventory levels and to determine optimum line operating conditions.

More precise blending of crude and products.

Better control of volatile injection to keep streams within predetermined vapor-pressure limits.

Remote and local automatic control of stations.

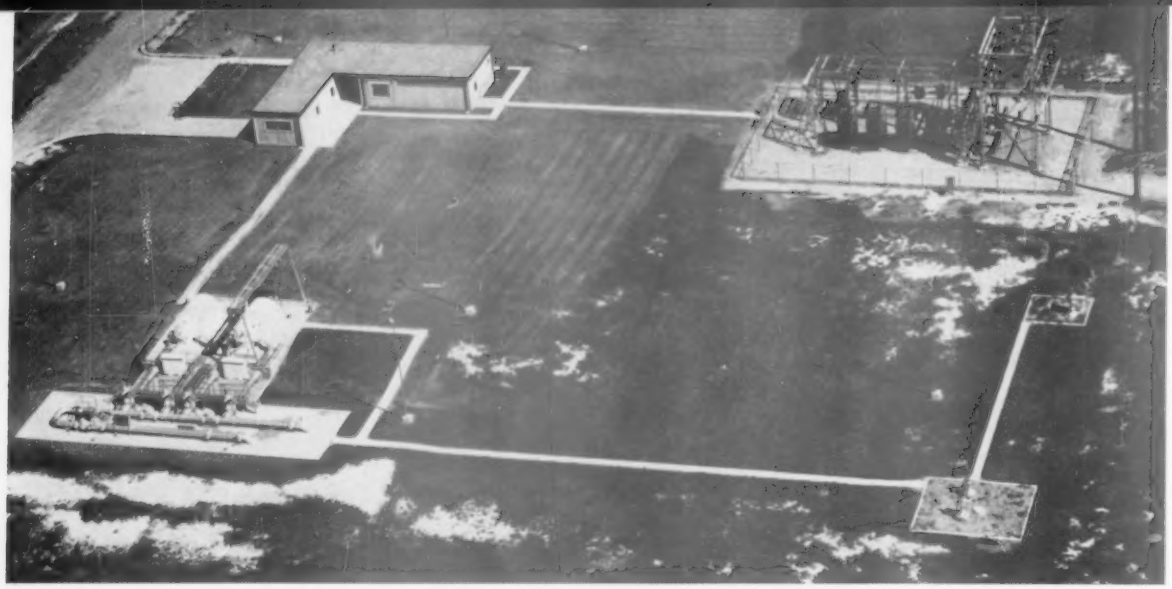
We can anticipate turning the job of scheduling, dispatching, and line operation over to the computer, but until we lick the economics we must see that our schedulers and dispatchers take advantage of all possible economies and efficiencies and continue to satisfy shippers' increased requirements.

ACT growing. Field automatic custody transfer will find increasing application. Gaging personnel must develop additional skills. They must recognize measurement errors in the automatic equipment, be able to make exacting calculations in determining meter factors, and analyze system operations to insure minimum oil losses with even fewer measurement check points.

These added responsibilities pose an obligation to train present gagers and supervisory personnel to handle automatic oil measurement. Even without automatic measuring equipment, quantity and quality measurement is becoming more exacting. Personnel must, therefore, develop and maintain techniques at a high level.

At terminals and tank farms, meters, remote gages, and complicated blending operations will all demand more skills than have been required.

The operations supervisor will require greater technical knowledge.



"MODERN STATION OPERATION has left us with the problem of reassignment of surplus operators . . . Although the personnel supervised will be fewer in number, they will be more highly skilled." This is the Katy, Tex., station on the Rancho Pipe Line System showing outdoor pumps, switchgear, shop building, and substation.

The personnel will be fewer in number, but they will be more highly skilled and supervisors must develop administrative and supervisory techniques to meet these new conditions.

Let us consider our scientific and engineering staff. One thing is certain. The shortage of competent engineers is not likely to ease and the competition from other industries will continue. Proper manpower planning and development in this area is the key to whether any substantial organization can expect to survive and grow in the atmosphere of dynamic technological changes. We must examine our present organization and improve its climate so that our engineering staff will improve their performance and efficiency.

Challenge needed. Technical personnel should be challenged to develop their ultimate potential. Pioneering and inventing must be made easier. The uninhibited inventor and idea man, even though he may not fit into our picture of the organization man, should not be discouraged.

Clerical and drafting chores must be removed from the engineer. If a so-called engineer is capable only of performing such chores he must be reclassified. Direct and free lines of intracompany communications for disseminating technical knowledge, new ideas, and problem solutions are important and must be strengthened. Active participation in technical societies and professional recognition through published reports is an excellent climate generator. Young engineers need to obtain a sense of recognition and achievement by being assigned to special, short-term, productive studies.

Field technical staff should be sized to handle problems within their geographic unit—except those requiring an expert with specialized knowledge or experience in a particular field. These specialized technical people will be carried on central office staff and free to service all activities in which a need exists. More and more detailed design and drafting work will be accomplished by contractors with company personnel providing the preliminary studies and general specifications.

New personnel. Of equal importance is the selection of new scientists and engineers. We must attract the most capable and make available to them not only operational engineering jobs, but also specialist jobs requiring special attributes in certain fields. Management opportunties should be open to those with the skills and desires. The emphasis will be on quality—not quantity.

Financial and statistical branches cannot be overlooked.

What kind of financial people do we need to fully benefit from the enormous opportunity and expense of computers and related equipment? What training must they have to integrate data processing and assure mechanization's economic usefulness as a valuable management tool?

Many of the old requirements remain: People with a fundamental knowledge of accounting who can think for themselves, who are energetic and imaginative. We must find more thinkers—people who are not afraid to think—who, in fact, will be afraid NOT to think. Security and idleness of mind have too often been permitted to feed on each other.

Thinkers needed. We need people who can direct their thoughts along definite avenues; who can analyze and pick at problems from all sides; who can separate the parts and understand their relation to each other and the whole; who can get to the bottom of problems instead of shadow-boxing with them; and then find solutions tempered with judgment, economy, and a dozen other things. The analytical mind is a basic requirement. Most important, financial people must have the ability to inform and report in convincing language which can be understood by management.

It is mandatory that operations personnel at all levels be fully informed of the costs of their operations. Further, they must be able

to analyze costs and justify them when necessary. This presents a two-fold challenge to the financial people—they must present costs in a usable form and assist in training the operations personnel to interpret them.

We need people who, with normal everyday requisites, are energetic thinkers, analytical in approach and concept, and able to communicate thoughts.

Schools lax. Not nearly enough are at hand. Too many schools turn out too many graduates who exercise their minds only upon very special occasions. Many courses require little independent thought, and too many graduates are helpless to express their thoughts. Our schools need to look at themselves and, among other things, eliminate from their curricula snap courses and fill-ins. They should train students to think for themselves and express their ideas effectively.

We can be encouraged that in some, business education is undergoing a change from the narrow, vocational, how-to-do approach to broader, more basic courses; and that emphasis is on training in the fundamental analytical tools that are essential to the solution of a wide variety of business problems. This is certainly the right direction.

We, in industry, seek individualism instead of conformity; but too often, we seem in practice to encourage the latter. Too often, thoughts dissimilar to our own are discarded before they get a chance to breathe. Too often, we do not test an individual's capacity until erosion has set in.

If we are to use the maximum abilities of tomorrow's employes, we must challenge them. On-the-job training experience should include assignments in methods and procedures, organization studies, and data processing. Every man should be a "methods" man with a working knowledge of machinery.

To keep up to date on the latest data-processing hardware and procedures, we should take advantage of programs offered by equipment suppliers and universities. To provide special training for particular jobs, it will probably be necessary for new employes to participate in more job-oriented seminars and in company-sponsored schools.

Management needs. Most difficult to appraise are the requirements for our future management group. It does not seem likely that top management will change much in size. As for the intermediate echelons, we might expect some contraction, just as we do in the staff and operating phases, as improved techniques and equipment permit greater productivity.

But the essential management function remains—directing the show. If it is to be done intelligently, the manager must know where he has been (he needs experience); he must know where he is (he needs information and alertness and sensitivity); and he must know where he wants to go and have a pretty good idea of how to get there (he needs judgment and resolution). He must get other people to do whatever is necessary, to do it as well as necessary, and to do it on time.

Where do we get managers?

At Shell we believe in homegrown management, and we tend the garden carefully. We never take it for granted we will get the new management through the trickle-up process.

Continuing review. We run a continuing program of review. Everybody knows that the opportunity is there for everybody. We start watching men early, but we make provisions for the late starter, the man who makes it through hard work, because, in fairness to this man and in the interest of the company, he should be considered for management development even though he may not have been identified as potential management material early in the game.

In finding new men for management, the easy part is determining the man's knowledge of particular subjects with which he is to deal and his ability as demonstrated through past performance. It is not quite so easy to gage his potential as indicated by observation, analyses, tests and interviews. These might all come out quite high in a man who would make less than an outstanding manager; for beyond these lie integrity, strength of character, ability to generate enthusiasm in others, to command respect and loyalty, to judge others, to assess information, select what is pertinent, and to decide calmly.

And how can we help managers become more efficient? By giving them the information they need to make good decisions. This means, among other things, electronic computers. They can provide more information than management has ever had, and they can provide it faster and in more useful forms. They can even indicate solutions to certain types of problems. They are valuable tools.

Computer an aid. Let's not be too quick to hand the keys to the shop to some U-shaped monster with a four-digit name and go fishing. These things are meant to help management, not manage. There is room for cool questioning about exactly how far these things can go in giving human managers an excuse for sidestepping the responsibility for decision. Indeed, they may do some of their best work in helping to keep managers on their toes.

Besides new equipment, tomorrow's management will also have the chance to use new techniques. The alert management group will not overlook such opportunities as those offered by the advanced training courses, and the technique some call "Operations Research."

"Manning for Tomorrow's Operations Today." What does it come down to? Getting new knowledge, devising new approaches so as to solve new problems, and thus achieve new levels of efficiency. And yet, is it really new? Is it revolutionary? No. There is nothing in any of this to be alarmed about, and probably nothing to justify public holidays and festivals of rejoicing. What we face is a continuation, perhaps with some hastening, of what has been going on since the start of the industrial revolution.

Man gets new knowlege in order to do things that improve his lot on earth. With each new step in gaining knowledge, each man can do more. Turned the other way, this means that as progress continues a given job will be done by fewer people. There will be some temporary adjustments. But the ultimate benefit is plain.

Look what's happened in push-button pipelining in just 5 years

...but more importantly, what will the next 5 years bring? This author believes the industry is now entering an era of "accelerated evolution"

BY FRED S. JONES

TECHNIQUES of pipeline operation have changed rapidly during the past 5 years. An analysis indicates that, without question, the industry is entering a period of accelerating evolution.

In 1956, very few companies were using automation for unattended operational control pumping stations.

In 1960, remote and automatic control had advanced to 37%, unattended operation to 22%, and partially attended operation to 21%.

These are some of the changes:

Remote Switching

Late in 1959, Platte Pipe Line Co. decided to install the necessary remote-control functions to open and close 17 tank manifold and main-line valves so any of 7 tanks could be switched from injection to receiving service. The actual tank-valve manipulation had previously been done by the station shift operators at Gurley, Neb. in accordance with the daily orders of the dispatcher in Kansas City.

The station was already equipped with a direct-connected gravitometer including an in-station remote recorder. The recorder relay loop was rewired to utilize the continuous power supply of the local microwave station. A remote telemetering relay and tone channel was added to transmit gravity information to Kansas City. A recorder was added there permitting the dispatcher to observe the batch cuts as they arrived at Gurley.

Cut detector. A temporary cut detector with an actuating switch mechanism was designed and constructed by Platte personnel. Its purpose was to investigate and prove the effectiveness of a programed cut-actuated tank-switching system and to provide for unattended tank switching while awaiting the delivery of remote-control equipment. The temporary tank-switching programer was crude but effective. A tank-switching program could be set up several hours in advance of the anticipated arrival of an interface and could be actuated by a rising or falling gravity as required at a discrete gravity value.

The programer was subject to local override on an elapsed time basis in case the cut was delayed by loss of pumping power upstream and also subject to a remotely actuated override, cancel, or initiate command from the dispatcher at Kansas City. The programer was taken out of service when complete remote control was installed but it did prove conclusively that local tank-switch programing is feasible and effective. The same principle, although considerably simplified, is in constant use at two other receiving points on Platte's system.

Gurley station. Gurley has four 55,000-bbl. tanks and three 120,000-bbl. tanks to store five different grades of oil. Each is filled and emptied through a common tank line. Each tank line is connected to the incoming and the outgoing headers.

The pumping equipment, 2,600 hp. in three different sized units, is remotely controlled and can be diverted from injection service to mainline boosting service by remote control.

The incoming and outgoing tank-

The author...

Fred S. Jones

Fred S. Jones, superintendent, engineering and communications, Platte Pipe line Co., participated in the development and construction of the company's extensive communications and remote-control system from the ground up. He has been with Platte since 1952, first as a microwave technician, next a communications engineer, and later as an electrical engineer. His present duties cover both administrative and technical responsibilities in mechanical, hydraulic, electrical, and electronic fields.

Trans-Canada Pipe Lines Limited Chooses Worthington SUTC's . . .

FOR FIRST FULL AUTOMATION

At central control, the dispatcher pushes a button. At the compressor station miles away, a solenoid throws an air valve. Engine and compressor cylinders begin purging . . .

At 6 seconds, ignition actuates, fuel is admitted and the engine slowly accelerates toward 160 rpm. At 20 seconds the compressor cylinders stop purging. In 5 minutes, the engine-compressor is ready to be brought on line.

This is a glimpse of normal operation of Trans-Canada Pipe Lines Limited's Maple Station--the first to be fully automated by this pipeline company. Three Worthington SUTC engine-compressors operate in pre-set sequences according to signals from the dispatcher who, though 25 miles away, could be a thousand.

These new SUTC's have a higher compression ratio for increased efficiency; improved handling of heat load through new computer-designed Turbo-Chargers; and new bearing construction. Cylinder parts and Double Deck valves were manufactured in Canada.

The station organization chart shows the benefit of these automated SUTC's. This station has no operators. This saves initial cost of four houses and salary and overhead for the operators.

For complete information on SUTC's for automated or conventional installations, call your nearest Worthington District Office. Or write Worthington Corporation, Dept. 43-22, Buffalo, New York. In Canada, Worthington (Canada) Ltd., Brantford, Ontario.

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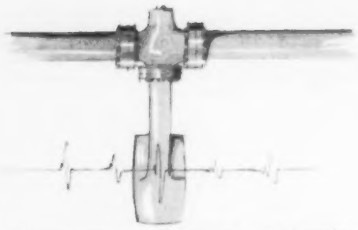
PRODUCTS THAT WORK FOR YOUR PROFIT



"Incoming and outgoing tank-header blocking valves, combination header bypass and main station suction valve, and individual incoming and outgoing tank valves are all motor-operated and subject to remote control and supervision from Kansas City."

header blocking valves, the combination header bypass and main station suction valve, and the individual incoming and outgoing tank valves are all motor-operated and subject to remote control and supervision from Kansas City.

Tank gaging. Gurley originally had a conventional tank-gaging system of tape-driven potentiometers and hand-calibrated D'Arsonval meters for feet and inches determination. It had also been equipped with a one-shot analog-type telemetering transmitter for remote transmission but the system did not prove practical.

A newly designed tank-gaging system utilizes the existing potentiometer-type transmitters with slight redesign. They are now interconnected with a new-style analog-to-digital converter which converts a potentiometer-derived voltage to tens of feet, feet, inches, and eighths of inches for local readout.

Remote transmission is accomplished over a slow-speed on-off radio-tone subchannel to the dispatch center at Kansas City. The existing remote-control equipment was used for tank selection. The security level of the remote-control system was sufficient to eliminate transmitting tank identification as a part of the tank-level data chain. If the security level had not been adequate, it would have been advisable to transmit the tank identification as a part of the data.

Savings in manpower. Remote control of tank switching is in its third month of operation. Although a number of shakedown failures have occurred, the system is working well enough to permit the transfer of one shift operator to another location. Platte now anticipates that the station will be semiattended by one or two station operators and, on a relief basis, by an area gager who has other duties at an adjacent remotely controlled injection station.

If the operation proves as satisfactory as it was conceived and designed to be, one more operator can be transferred to other duties, thus reducing the attending personnel to one resident operator and one part-time area gager. Before the Platte system was equipped with remote control, this station was attended by six full-time operators.

Conclusions. Switching tanks by remote control is considerably more involved than to remotely operate a multiunit booster station. Platte has operated with a high ratio of remotely controlled stations for years and has conclusively proven that such operation is economical and dependable, provided adequate protective devices are installed.

The tank headers are protected with a pressure-relief system and remote alarm. The tank valves are equipped with local electrical interlocks. A remote stop function is installed to allow instant stops and reversals if required. Booster pump controls are interlocked with the outgoing tank valves. When the tank valves crack open, the booster pump starts; when the tank valves close, the booster pump stops.

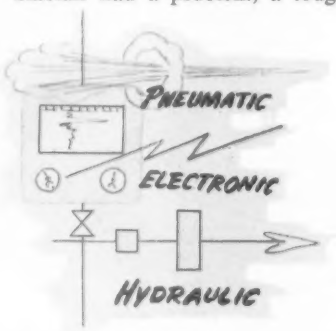
Later this year, two-way three-port check valves will be installed in the tank lines, thus eliminating the need for manual prepositioning of the circulating line valves. The over-all task has been challenging but the first measures of success have been rewarding. Remotely controlled tank switching on the Platte system is a reality.

". . . one more operator can be transferred to other duties, thus reducing the attending personnel to one resident operator and one part-time area gager."

Hydraulic Control

Through the cooperation of a leading manufacturer of hydraulic controls and Sinclair Pipe Line Co.'s general engineering department, a new concept of precise pressure control of pipeline pumping stations has been successfully applied. Hydraulic control systems have been in use for many years but none such as this.

Sinclair had a problem, a tough problem, which all of us hope to face. It needed to pump at maximum capacity 100% of the time and do it in the face of fast-changing pressure upsets near pipe bursting limits. To squeeze every barrel possible through the system, they needed a fast-acting heavy-handed control system that would control effectively but allow virtually no pressure overshoot.



"Seven companies installed and tested their control equipment: three pneumatic, three electronic, and one hydraulic. All gave fair to good results but the hydraulic system excelled in every respect."

Sinclair simplified specifications to the extreme at the outset by limiting the pressure overshoot to 5 lb. maximum beyond the normal pressure set-point levels. Then they invited a number of suppliers to subject their products to an operating test at Sinclair's products pump station at Copan, Okla. Seven companies installed and tested their control equipment: three pneumatic, three electronic, and one hydraulic. All gave fair to good results but the hydraulic system excelled in every respect.

System's features. Some of the outstanding features of the hydraulic signal pressure control are:

1. Control action is instant, fast, and stable. It starts near the set point with a fixed gain of 50. Pressure changes of 100 lb. per second magnitude were handled with less than 5 lb. overshoot.

2. Signal lag and windup do not exist in the hydraulic control loops. The only lag is the stroking time of the valve.

3. The controller is designed for outside installation so it can be located immediately adjacent to the control valve. Control piping is very short.

4. The valve action is fast. Most valve-actuator manufacturers are reluctant to produce fast-action actuators to match modern electronic control systems. Thus, good controller action is often lost in the valve lag.

5. The system is simple and easily adjusted by personnel already acquainted with pumps, pressure gages, and hydraulic lines, but not with electricity, wires, meters, milliamperes, volts, etc.

6. If pressure overshoot can be limited to 5 lb., the pressure gap between the set point and shutdown limits can be decreased from 40-50 lb. to 10-15 lb. This 30-35 lb. can be used for pumping instead of wasting it as most companies do now.

Aided company. By organizing the competitive tests, Sinclair helped itself in two ways:

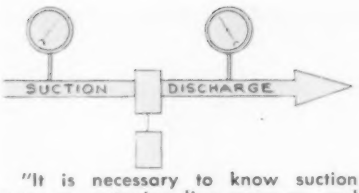
1. It discovered a pressure control system capable of performing a tough task to their satisfaction.

2. Its engineers and operations supervisors gained a considerable knowledge in the field of dynamic pressure control on an operating pipeline system.

The manufacturers, regardless of their standing, learned a great deal about the operating characteristics and attendant problems of everyday pipeline operations. The results clearly indicated that some either didn't anticipate the problems or didn't know the characteristics of some of the problems of a "tight-line" pumping operation.

Review conclusions. After reviewing the Sinclair program. I think that:

1. Sinclair should be congratulated for organizing the test along scientific lines so that definite characteristics of throttling-valve control systems could be set down as numbers and quantities rather than intangible guesses and opinions.



"It is necessary to know suction pressure, outgoing line pressure, and station differential pressure to thoroughly control a booster pumping station remotely."

2. We should learn the advantages of sensitive, fast-acting, stable control systems and use them to our advantage.

3. We should encourage process control-system manufacturers to direct more talent and research toward control systems specifically for modern system pipelines and refuse, if necessary, to adapt general-purpose process-control systems.

4. We should encourage throttling-valve manufacturers to take a critical look at valves for normally open pipeline-throttling service and direct attention to a valve which will yield a control action more suited to dynamic pipeline pressure control.

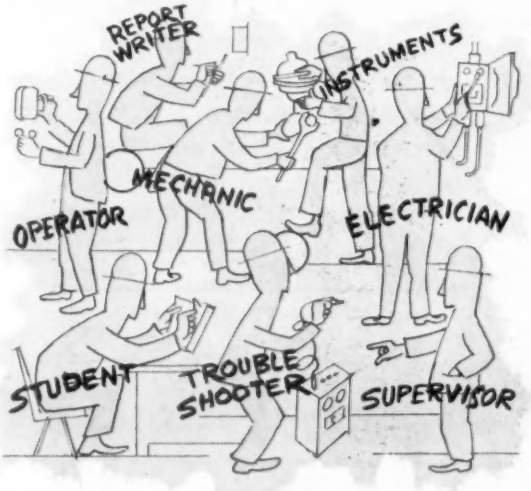
Alternate Pressure Telemetering

Almost all agree that some kind of telemetering is needed to complete remote supervision and control of pipelines. Very few agree on the methods of extraction, transmission, and presentation of the data. Our telemetering technique is not all new but it does present some definite advantages over methods in common use.

It is necessary to know suction pressure, outgoing line pressure, and station differential pressure to thoroughly control a booster pumping station remotely. This is true especially when a multiple station trunk pipeline segment is involved. By observation of the pressure patterns and by intelligent selection of pumping power, it is possible to arrange the pressure distribution and input powers to achieve the highest throughput at minimum cost. That's what everyone is seeking no matter how it is accomplished.

For several years, the Platte dispatchers have observed station pressures and outgoing line pressures and mentally compared the two to make decisions to add or reduce pumping power, shift the system pressure pattern, shift the electrical load to stations with lower cost power, etc. Some might argue that this is a job for a computer but with experience, and knowledge gained from that experience, the task is demanding but not especially difficult.

Difficult, costly. It is difficult and costly, however, to maintain reliable operation and absolute calibration accuracy of two telemetering transmitters, two telemetering communications circuits, and two re-



"A good maintainer is a good mechanic. He must be knowledgable about electricity, instrumentation, trouble shooting, report writing, supervising, and must be a good student, and willing to study to improve his acknowledge."

Congrats and $25 for this quip to Mrs. Merlyn Goodman, Rt. 5, Box 742, Shreveport, La.

Looking into the future . . a major oil company engineer predicted 50,000 ft. wells by 1975. The world demand for oil and gas, with deeper wells, will mean a constantly increasing pipe production schedule by Lone Star Steel.
Joe Roughneck, heart of the oil and gas industry, knows he can depend upon Lone Star as a convenient source of supply for top quality API casing, tubing and line pipe.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

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ceivers per pump station. By alternately telemetering suction and outgoing line pressures from one receiver, the maintenance is halved and at least two intrinsic advantages are realized.

One is differential pressure accuracy. By using the same transmitter and the same receiver over one circuit to measure two pressures alternately the absolute calibration and chart reading inaccuracies cancel. The station differential pressure as read from the chart is more accurate than either the suction or the outgoing line pressure as it should be.

The other advantage becomes obvious when a station chart is examined. The alternate trace actually shades the chart and pictorially presents a performance record to be compared with optimum conditions. By quick across-the-room examination of a large number of charts, the dispatcher can readily determine the existing pressure pattern, trend of change if any, and excessive throttling at any station is immediately evident and measurable.

Simple, cheap. The equipment needed to alternately connect the station telemetering transmitter directly to the suction and outgoing line pressure take-off-points is quite simple and relatively inexpensive. A repeat cycle timer with adjustable "on" and "off" cams controls a miniature three-way valve which selects suction pressure for a certain time period, purges the instrument piping during the valve transition period, then selects outgoing line pressures for the remaining time as determined by the timer cam settings.

When Platte first attempted to develop this technique, a suitable valve for the job was not readily available but a major manufacturer of miniature valves and actuators now has the combination listed as a catalog item.

The technique of alternate telemetering, including the advantages to the dispatchers and to the maintenance technicians, is so appealing to Platte that a complete changeover to this principle is in process at this very moment.

Area Station Maintainer

The reason for the neat appearance of a well-maintained station

is simple. A good maintenance man has done a good job.

Several years ago, Platte and others started installing remote-control facilities and extra protection equipment to fully attended pump stations. After the shakedown, part or all of the staff was removed from the station. The unattended station was then usually visited every week or so from an adjacent fully manned station, by the mechanic, the electrician, or others. As more and more stations were converted to remote control, it was obvious that other arrangements would have to be made for station maintenance. It was at this stage that the job of station maintainer was created.

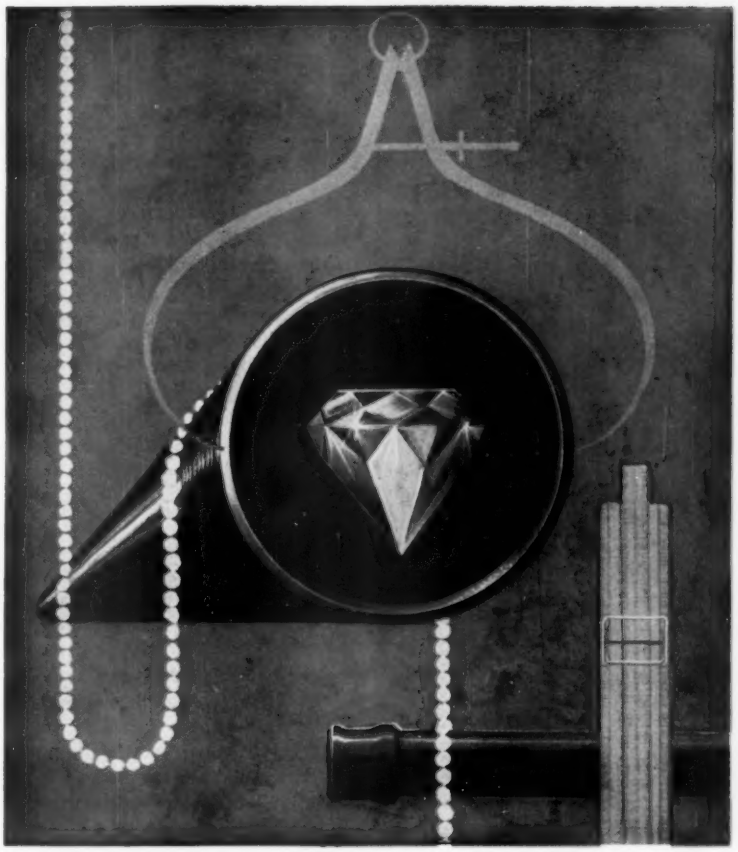
Qualifications. Probably one of the most important qualifications for a maintainer is **interest**—interest in each item of equipment and interest in making automation work. Ability or even excellence as a mechanic, electrician, instrument technician or station operator is not enough. The man must have a sincere interest first. Maintenance ability will follow with good instruction and experience.

To list all the qualifications of a good area maintainer would be difficult indeed, but here are the general qualifications:

Operator. He must thoroughly understand all types of pump-station operation — manual, local, automatic, and remote control. He must understand and must know how each station is related to the system. He must know, in detail, how all equipment in the station operates, either as a unit or as part of the entire station complex. A good maintainer is a good station operator. The reverse is not necessarily true.

Mechanic. He must possess a high level of mechanical ability. He doesn't have to be a craftsman but he will have to know how to maintain motors, pumps, valves, and other mechanical devices. A good maintainer is a good mechanic. The reverse is not necessarily true.

Electrician. He must have enough knowledge of the fundamentals of electricity to enable him to disconnect and connect electrical devices, make simple repairs, use ordinary test equipment to trace wiring, detect opens and grounds, and use the tools of an electrician. A good



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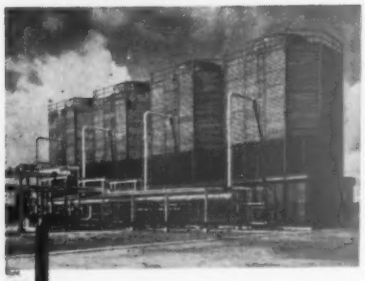

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maintainer is a good electrician. The reverse is not necessarily true.

Instruments. He must know how each instrument is connected to the measured variable, how it works, what it records, how it is calibrated, and how to replace or repair it. If the instrument is faulty, he must be able to describe the trouble to a technician in the proper technical language and follow specific directions in the repairs.

Trouble shooter. He must develop the ability to detect and isolate trouble quickly and accurately. It may be necessary to isolate a piece of faulty equipment and keep the rest of the station in operation until a mechanical or electrical technician can make major repairs. A good maintainer must be resourceful.

Report writer. He must be able to write good reports and keep a complete log of maintenance activities. A detailed log written in a methodical manner is often vitally important to technicians who visit the station on maintenance calls when the maintainer is not present.

Student. A good maintainer studies constantly to improve his knowledge. In order to reach a complete understanding of how each piece of equipment works and how it is related to station operation, he must study instruction books thoroughly and fortify his study with actual experience, or drilling, in maintenance so when the time comes for a major repair, he is thoroughly qualified to assist.

Supervisor. A good maintainer must develop the ability to be a good supervisor. Since he must work alone most of the time, he must be able to supervise himself which is considerably more difficult than supervising others. This qualification is probably hardest to determine before selection for the job, yet one of the most important to the man's ultimate success in the job.

We can conceive the most advanced design of pumping stations, we can buy the best equipment possible, we can install complicated interior control systems, we can even add protection equipment to protection equipment, but no matter how well individual pieces of equipment are made, they are still subject to failure and they can't maintain themselves. This is where the maintainer concept of maintenance procedures comes into prominence.

One man, highly mobile, well-trained in all kinds of maintenance, can perform routine maintenance tasks and intelligently determine and report the condition of several stations. Through his initiative and developed abilities, the entire pipeline system will benefit. Highly trained specialists are thus freed from routine maintenance tasks to devote their skill and energy to major repairs and adjustments.

Automatic Welding

Automatic over-the-ditch welding moved closer to reality during 1960. Pipeline construction and welding experts have been researching the problems and developing the equipment for several years. Their labors are now being reflected in ingenious new machines.

Shielded Arc Welding

Esso Research & Engineering Co. recently disclosed a new automatic pipe-welding device which may well revolutionize field pipeline welding.

Esso developed the process with Battelle Memorial Institute, Air Reduction Sales Co., Crutcher-Rolfs-Cummings Co., and Bauer Associates. A prototype was recently tested under actual field conditions and all reports indicate that it did an outstanding job on a mile of 6-in. X-46 pipe.

M. J. Dabney, who directs pipeline research for Esso, says the process will work on pipe of any size by tailoring the physical size of the machine to the range of pipe sizes to be handled.

Head rotates. The new process does not rotate the pipe during welding; the welding head rotates around the pipe. After the automatic welder is positioned on the pipe ends, which incidentally are not beveled but are cut perpendicular to the pipe, the ends are laterally aligned by an internal clamping device. An optical device on the outside is used to insure longitudinal alignment. The pipe ends are then securely locked in place, the internal clamp is removed, and the actual welding process is ready to begin at the touch of a button.

A high-speed cutting wheel rotates halfway around the pipe from

top to bottom slicing out a narrow gap. The other side of the pipe remains butted together firmly and held rigidly in alignment. The electric welding head, complete with automatic welding wire feed and a carbon dioxide gas shield, then moves automatically through the same arc completing the weld. The process is then repeated on the other side of the pipe.

Speed is high. The cutter blade even cuts out a portion of the first weld to insure complete welding encirclement. The welding process, all automatically timed and controlled, progresses at about 50 in. per minute. Movement from location to location and the alignment procedure consumes considerably more time than the welding. It has not been determined just how many welds per hour can be made under continuous field operation but this much can be predicted from the results now available.

The actual welding process is about 20 times faster than current manual methods. Estimated moving and lineup time will probably not consume more than 5 minutes per joint. The weld itself has a rectangular cross-section about ⅛ in. wide; its strength will meet all current specifications even though its appearance is considerably different from the usual triangular cross-section weld.

Observers who have witnessed the operation of the new welder have said that it is ready now for field operation. This may have been the most outstanding development in pipeline construction during 1960.

Induction Welding

The Petroleum Equipment Branch of the United States Army Engineer Research and Development Laboratories at Fort Belvoir, Va., is busily engaged in the development of an induction-heating pressure-welding process. C. W. Karstens, chief of the branch, reports that the project is now developed to the point that consistently good laboratory welds are being made. The next phase will involve actual field welding conditions.

The goal is to develop equipment and techniques which will ultimately yield high production rates with a minimum of personnel and logistical support. It is hoped to add

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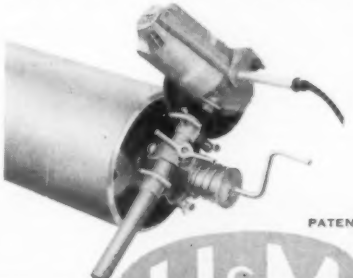

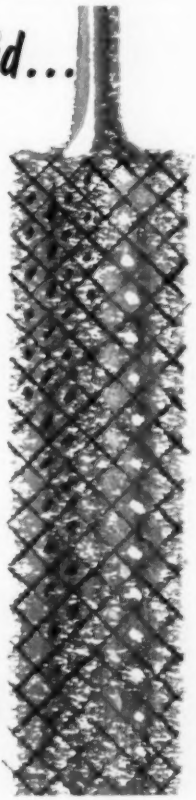

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a 60-ft. joint of 8-in. pipe every 2 minutes which will make it possible to build pipeline at the rate of 1 mile every 3 hours in any kind of weather over virtually any kind of terrain.

The experimental unit was fabricated by Swift Ohio Co., of Kenton, Ohio, and the prototype model was delivered in October 1959. The project was temporarily terminated in January 1960 for budgetary reasons. Since then, a number of demonstrations have been conducted, one of which was attended by a number of representatives from the petroleum industry.

"The induction coil couples about 100,000 watts of 3-kc. power into the area of the joint, producing a temperature of 2,600° F."

No rod, flux. The unique feature of this process is that no rod and no flux are needed. The mechanical preparation consists of an end milling process to assure uniform peripheral contact and an expanding process which assures that the pipe ends to be joined are perfectly concentric.

After the preparatory mechanical process is completed, the two pipe ends are pressed together with a force of about 2,900 psi. and then the induction heating ring moves to a position over the joint. The induction coil couples about 100,000 watts of 3-kc. power into the area of the joint producing a temperature of 2,600° F. After the joint is heated for about 25 seconds, the hydraulic ram applies approximately 500-ton forging pressure to complete the weld.

The total elapsed time for the process from lineup to completed weld is 90 seconds. The resulting weld has no internal upset and only a small bulge on the pipe exterior.

Karstens reported that a formal engineering report has been started but the publishing date has not been set. The laboratory wants to cover the project with a comprehensive paper sometime soon and show some films of the welder in action. From the information received to date on this project, it appears that a paper on this project would be of intense interest to the pipeline industry.

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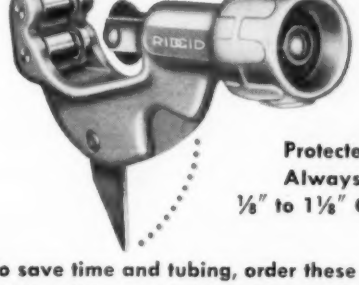

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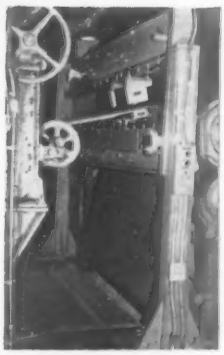

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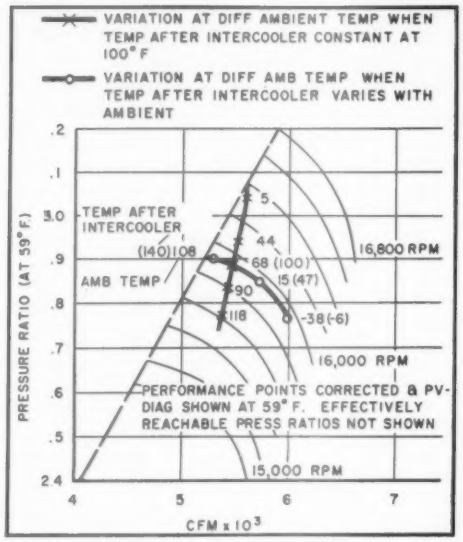
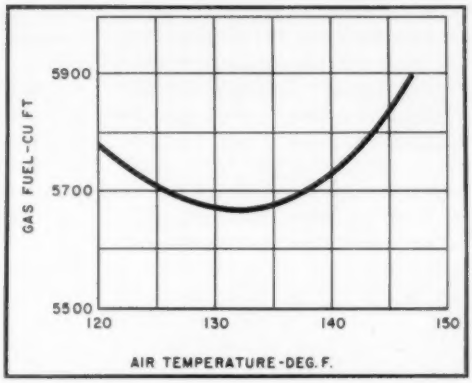


BLOWER PV-diagram. Fig. 6.



EFFECT of air-manifold temperature on fuel consumption. Fig. 7.

BY ERIK KELGARD
Trans Mountain Oil Pipe Line Co.,
Kamloops, B. C., Canada

Maintenance pays off for dual-fuel engines

This is the second part of a two-part article on the operation of dual-fuel engines in pipeline service. The first appeared in the April 17 issue of The Oil and Gas Journal.

IF STEPS ARE TAKEN to keep the air-fuel mixture at the best value consistent with good engine maintenance, the dual-fuel engine is the most economical and reliable prime mover in use today.

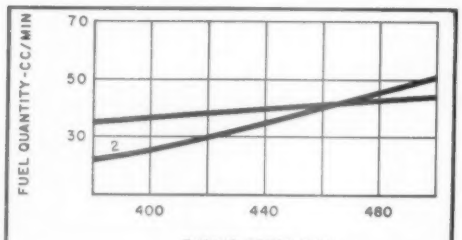
Air-fuel ratio adjustment is the principal factor for economical engine operation, but other factors must also be considered. If the turbocharger adjustment is made when ambient temperature is high, a decrease in temperature will reduce fuel economy and may also lead to surging of the compressor.

At Trans Mountain Oil Pipe Line Co. stations, summer temperatures of 100° F. are not uncommon while temperatures of −50° F. are encountered on some days each winter. The resulting change in air density, if not counteracted, would seriously affect fuel consumption.

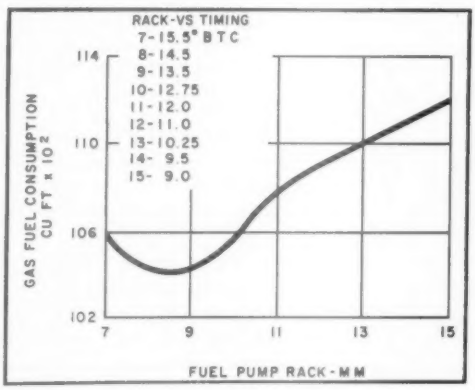
On fixed-guide-vane turbochargers operating at low temperatures, the increase air flow is bypassed to the suction side of the blower. This is not an ideal solution for the reasons already stated, and exhaust temperatures are somewhat higher when the bypass has to be used.

For surge control, however, the

Presented at 1961 ASME Oil & Gas Power Conference.

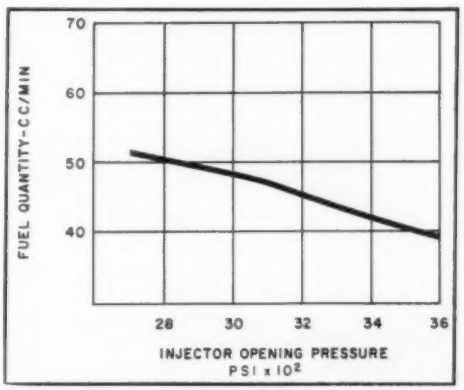


EFFECT of speed change on pilot-fuel quantity. Fig. 8.



EFFECT of pilot-oil timing on gas-fuel consumption. Fig. 9.

EFFECT of fuel-injector opening pressure on fuel quantity delivered. Fig. 10.



bypass method is preferable. It will be seen from the PV-diagram, Fig. 6, that if the blower is in surge at a given speed, reducing speed only results in the blower surging at the reduced r.p.m.

Better method. A better method of offsetting low-temperature, high-density air is to use exhaust gases to heat the air to the rated temperature of the blower. With an air-to-fluid heat exchanger, hot jacket water could also be used for the same purpose with the added advantage that during hot summer months, preblower cooling of the air would also be possible. Fig. 6 shows the effect of changes in ambient temperature on turbocharger performance.

When low engine load coincides with low ambient temperature the temperature of the air leaving the compressor falls below that required for the inlet manifold. The Trans Mountain engines have been equipped with automatic valves sensing on manifold temperature so that, when required, hot jacket water can be passed through the intercooler to maintain air temperature constant.

This same valve also maintains the temperature of air when cooling is required at higher loads. Fig. 7 shows the effect on fuel efficiency with changes in air-manifold temperatures.

Oil to Gas Change

When operating dual-fuel engines in pipeline service, problems are sometimes encountered when switching an engine from oil to gas. This problem relates to differences in the position required of the governor when the engine is operating on gas as against that for oil, and is particularly troublesome when the station is operating close to a control point.

When operating as a diesel engine the quantity of oil needed to be injected into the cylinder per stroke is the same (or very nearly so) at, say, 160 brake mean effective pressure (b.m.e.p.) at 500 r.p.m., as it is for the same b.m.e.p. at 400 r.p.m. The governor therefore is concerned only with speed.

Speed-load control. On gas, and regardless of whether the control is by single or multiple orifices, the governor must control for both speed and load. Therefore, the governor power piston does not follow the same line on gas as on oil, and when the fuel-selector handle is moved from one fuel position to another, there is a time lapse while the governor servopiston moves to the new position. If this variation is large, the engine will be subject to a sudden speed change that may cause the station to be shut down by one of the safety controls guarding the pipeline.

Another problem arising out of supplying fuel gas to the engine at constant pressure, concerns the equal distribution of gas to the cylinders when operating at the lower end of the load range.

Ratio Controller

We have overcome these problems by installing a ratio controller that changes the gas-supply pressure with load changes. The "set" air for this controller comes from the engine gas-distribution header. This header is open to cylinder pressure during the time the gas valve is open, and therefore reflects

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load directly since cylinder-air charge follows load.

The air output from the controller goes to the top of the gas-pressure regulator where air pressure is used to replace the normal load spring. The ratio of output air to set air is determined experimentally for each engine when cylinder loading is first balanced. Once balance has been achieved the adjusting handles are removed, and if an unbalance occurs after the metering has been established, we look for the cause elsewhere. Generally, we find it in the pilot fuel system; either an injection nozzle that has gone bad, a change in pilot metering due to war in fuel pumps, or parts failures such as broken springs.

Gas-pressure-ratio adjustments are made after all other adjustments have been carried out. With this arrangement the governor will maintain the same position for the same load regardless of speed.

Dual-advantage. There is a secondary advantage in this system. The governor orifice is operated in a more open position and the normal movement of governor linkage does not give rise to the pressure surges experienced on low loads when the governor, without pressure regulation, gives an almost on-off type of control because of the very small opening.

These pressure surges affect metering accuracy to the individual cylinders and cause the engine to run rough. If this pressure-surge condition is attenuated by installing a larger-capacity distributing header, there is an increased quantity of gas presented to the engine beyond the control of the governor which makes speed and load control more sluggish.

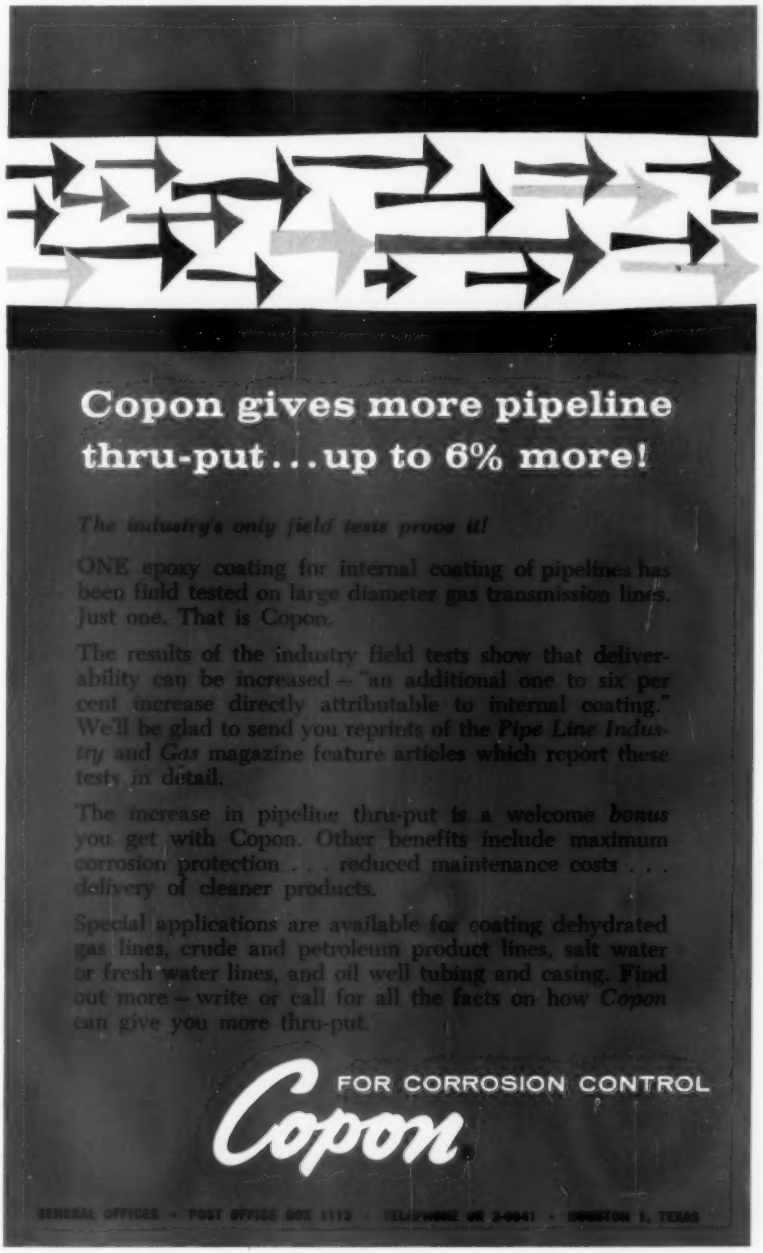
It is also hazardous if the engine shuts down because of one of the safety controls on the pipeline. While these act to shut off the gas fuel to the engine, the pilot fuel also stops and the excess gas present in the large header cannot be burned before the engine stops. This must be purged before the engine can be started again safely.

Pilot-oil metering is a relatively simple matter on dual-fuel engines in power-generation service. In these engines pilot quantity remains constant over the load range, being a function of fuel pump-rack position and speed. With variable-speed engines one would naturally assume that this relationship between rack setting and speed would hold so that pilot quantity per cycle would remain constant.

Unfortunately, this is not so. Line 1, Fig. 8 shows the amount that would be injected if the quantity varied directly as speed. Line 2 shows the quantity actually metered.

This reduction in quantity injected is due to the change in the ratio between the quantity trapped when the plunger closes the supply port of the fuel pump to the quantity of fuel that leaks off between the pump barrel and plunger back to the supply port. The leakoff quantity stays almost constant regardless of speed because, in point of time, the period when there is a high pressure in the pump is the same regardless of speed.

Varied with stroke. The total fuel trapped varies directly with pump strokes and at low speed a smaller quantity is available for injection than when speed is high. This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problem is aggravated by wear in the fuel pump.

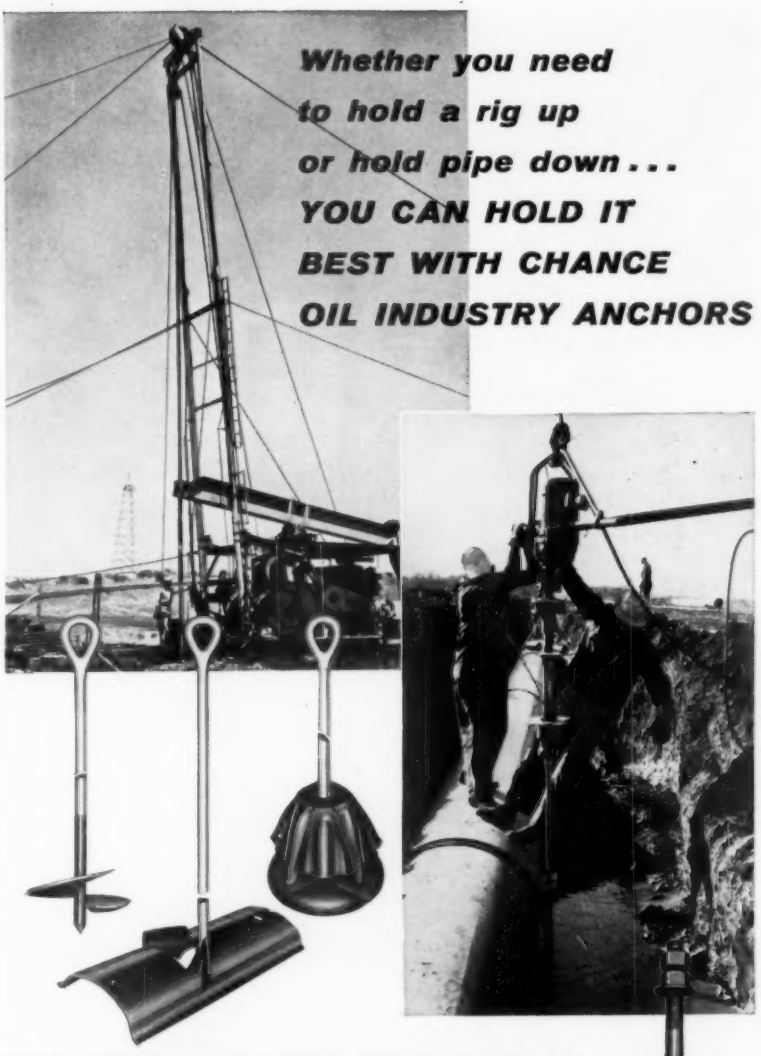
The problem presented by this change in delivery to the fuel nozzle gives trouble in two directions. First, when operating at lower than calibrating speed, the quantity of fuel passed to the injector may become so small that the injector ceases to function. Between this speed and the speed at which the pumps were calibrated, there is a steadily decreasing penetration of the fuel through the combustion chamber resulting in ignition delays of the fuel mass; i.e., a smaller number of ignition points are established. With the delay in burning the fuel, there is less expansion and fuel efficiency drops. This is true if injection timing is fixed.

Conversely, when speed increases above calibration speed, a greater penetration results in a larger number of ignition points and faster combustion. If injection timing at calibration speed is set for best efficiency this results in too early ignition at high speed to a point where power is lost.

Calibrating speed should therefore be chosen with the normal operating speed in mind, and, if this is likely to shift materially in one direction or the other, the speed at which fuel-pump calibration is done, should be changed. Timing can do something to alleviate the problem of changes in pilot-oil delivery, but, the actual limits, as we have found them at Trans Mountain, are within about 50 r.p.m. each side of the calibrating speed.

Calibration. We have found that pumps stay in calibration reasonably well for about 5,000 operating hours. However, if major changes in throughput should make frequent recalibrating necessary, a calibration stand is a great asset. We have recently built such a machine and have found it a great time-saver, as against calibration of pumps on the engine.

As indicated in the discussion on pilot-oil quantity, injection timing has a marked effect on fuel efficiency. Fig. 9 shows the effect of fuel-injection timing variations with the engine running at constant speed. It will be seen from the curve that a 3° change in fuel timing affects fuel consumption by 7%.



GUY YOUR DRILLING OR SERVICING EQUIPMENT with Chance Screw Anchors, Chance Expanding Anchors, or Chance Plate Anchors. Depending on soil conditions, and the load to be held, and whether the installation is to be temporary or permanent, one of the three is just right for any application.

SOLVE PIPELINE FLOTATION PROBLEMS with Chance Pipeline Screw Anchors and Tie-Down Brackets . . . the surest, easiest, and most reliable way to anchor pipelines. Your costs will drop about 85% compared to counter-weighting, and you can have the whole project engineered, supervised, and tested by Chance technicians under the Chance Field Service Plan. This cuts time and labor costs . . . makes certain the anchoring is adequate for every foot of pipeline. We'll also supply special installation equipment and the services of an installation supervisor for a reasonable fee.

CO61-9

For complete information, contact: Petroleum Equipment Engineering and Service Division of

A. B. CHANCE COMPANY

1311 Polk Ave., Houston 2, Texas, Phone CApitol 8-2777

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measurement
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Unaccounted for product can mean the difference between financial profit and loss . . . success and failure. Since metering provides the most reliable method of product accounting, Pipeline Operators pick the most accurate . . . the most dependable meters. They specify GRANCO Duo-Rotor Turbine Meters for all ACT operations.
GRANCO offers straight-thru flow design with lowest pressure drop, maximum operating efficiency. Twin turbines with opposite pitch, geared as a unit, provides twin drive power for unwavering accuracy on all flows . . . high or low. GRANCO offers low maintenance too. Turbine units are interchangeable without disturbing the pipeline.
Capacities to 40,000 BPH, sizes to 30". Available with counters, temperature compensators, pre-controls, remote controls, balanced valves, accumulators.
For LACT Operations...GRANCO P. D. Meters
For accurate, dependable measurement in basic Automatic Custody Transfer products, GRANCO five-blade rotary type P.D. meters provide smooth, non-pulsating, trouble-free performance. Rugged construction, updated design assure top accuracy, long-life durability. (Sizes 1½" to 8". Capacities 40 to 2000 gpm.)
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It is clear that next to correct air-fuel ratio proper fuel timing is of the greatest importance. It is also difficult to keep on top of because of the many variables that influence the start of combustion. Fig. 10 shows the effect on fuel quantity with changes in injector opening pressure for the same fuel pump metering at constant speed.

Here again, variations affect performance, because fuel spray patterns between cylinders will not be uniform. Varying amounts of pilot fuel will upset engine load balance and cause the governor to hunt, further upsetting the engine. Fuel consumption will increase because air-fuel ratio will not be uniform.

Maintenance Factor

This discussion has been aimed at pointing out those things that affect fuel economy. Since it can be shown that good fuel economy generally results in reduced maintenance cost, there is an opportunity for greater savings than from just the reduction in fuel. This in itself can amount to about 20%.

The average load carried by our engines is about 60% of the rated capacity. We have been able to show during engine tests that in this range a fuel consumption of 6,200 B.t.u. (total) is possible. Our monthly records will show an average consumption of about 6,500 B.t.u. per b.hp.-hr.

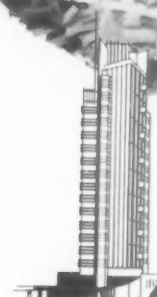
Automatic Controls

It is believed possible to approach the test results on a continuing basis only if greater use of automatic controls are resorted to. This is particularly true for control of air-fuel ratio changes due to changes in the ambient temperature.

Whether the expense of installing such equipment is justified by the fuel saving possible will depend on the unit price for fuel and the additional capital and operating charges connected with the installation of the new equipment. Lacking automatic controls, an orifice plate and manometer in the gas-supply run is a valuable aid in obtaining the best adjustments.

In the oil-burning diesel engine the reduction in fuel efficiency from having excess air is offset to a degree by the greater ease with which the fuel droplets can find

"... pacing the pipeline construction industry
for more than a quarter century"



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Warren's High Pressure Screw Pump is proving its true economy with pumping efficiencies of 75% to 85% – on either high or relatively low viscosities

Warren #8CB Screw Pumps handling crude oil at a primary pumping station.

In crude line, product line and refinery jobs Warren High Pressure Screw Pumps —

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- maintain constant capacity and pressure, even on oil containing foreign matter
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WARREN, MASSACHUSETTS

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sufficient oxygen for combustion. Improvements here would be in the direction of better fuel atomization and distribution.

Excess air will not prevent the fuel from burning as long as compression temperatures are kept high enough. In the case of the gas-burning dual-fuel engine, lean air-fuel mixtures have marked effects on the burning of the fuel and, if the mixture becomes too lean, may make combustion impossible.

Most economical. If this is properly understood and steps are taken to keep the air-fuel mixture at the best value consistent with good engine maintenance the dual-fuel engine is the most economical and reliable prime mover in use today. Because there are more things that field personnel can do to maintain and improve this high efficiency, it is also a very rewarding type of engine to operate.

It does require that the operators be well trained. Our company has gone to great lengths in running training courses for operators and it has been gratifying to see the interest shown by station personnel in obtaining good results when they are kept informed of the purpose and reason behind new operating methods.

With rising costs and ever-increasing competition there should be no room for acceptance of compromise methods of operation. Only the best possible should be acceptable.

Oil-pipeline construction is up

EXPENDITURES on crude oil and products pipeline construction in 1960 amounted to $133,836,000, according to the Association of Oil Pipe Lines. It was a substantial increase over 1959 when construction costs came to only $88,866,000, the lowest for any postwar year. The association predicts that 1961 will be another good year.

Construction in 1960 included 502 miles of crude-oil lines from 2-22 in. in diameter, and 3,632 miles of products lines from 4-10 in. in diameter. More than half the crude lines, 262 miles, consisted of 8-in. Most of the product lines were 6 and 8-in. diameter.

Charles Rutter, Chief Corrosion Engineer for the Equitable Gas Co., and Carl Barclay, Koppers serviceman, examine Bitumastic pipeline coating.

"Experience is what really counts and Koppers servicemen have plenty of it"

That's what Charles Rutter, Chief Corrosion Engineer for Equitable Gas Company, had to say about the services of Carl Barclay, Koppers serviceman, after the completion of Equitable's Farmington, West Virginia 16" gas line.

Mr. Rutter added, "That man knows all the ins and outs of pipeline coating and construction. He was on the job with the survey team before it was started and he stayed until the very finish. When our men came up against a problem they couldn't solve, Carl Barclay had the answer. You can't beat having a Koppers specialist on hand who has worked on every kind of coating problem there is."

Equitable's new line runs from Lumberport to Farmington, W. Va., and is part of a general expansion of the utility's facilities to meet the growing demand from customers in Western Pennsylvania and Eastern Ohio. The entire line was coated with Bitumastic No. 2 Enamel after cleaning and priming. For Carl Barclay this was another opportunity to put his experience to work—experience that includes pipeline work in every state of the Union and Canada.

When you are planning an expansion of your current pipeline facilities, it will pay you to specify Bitumastic coal-tar enamels —as well as performance-proved products, you'll get experienced counsel from Koppers. For more information send the coupon or write: Koppers Company, Inc., Tar Products Division, Pittsburgh 19, Pennsylvania. District Offices: Boston, Chicago, Los Angeles, Pittsburgh, New York and Woodward (Birmingham) Alabama, and in Houston, the Mavor-Kelly Co. In Canada: Koppers Products, Ltd., Toronto, Ontario.

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COATINGS AND ENAMELS
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Gentlemen:
I would like a copy of your booklet on pipeline coatings, "How Long Should A Pipeline Last?"

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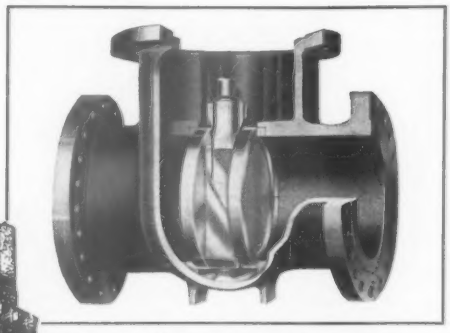

Cutaway shows the extreme simplicity of Darling's unique fully revolving double disc parallel seat gate valve principle.

YOU CAN DEPEND ON

Darling

For long-range economy on pipelines, standardize on Darling cast steel gate valves. The fully revolving double disc parallel seat and wedge construction automatically compensates for valve seat distortion, distributes disc and seat wear uniformly, and minimizes friction. These valves open fully and close easily even under severe pressure loads and radical temperature changes. *You can depend on Darling!*

The four working parts can be replaced without removing the valve from the line. You save valuable time when, after extended operation, it becomes necessary to service the valve.

Write, wire or phone for detailed information on Darling gate valves—available in pressures and constructions for main and gathering lines, tank farm and other services.

DARLING VALVE & MANUFACTURING COMPANY

Williamsport 1, Pa.

Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ontario, Canada
Vannes Darling-France, 23 rue du Commandant Mouchotte, St. Mandé, France

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What's NEW . . . in equipment

Need more facts on the items described on these pages?

The manufacturers will gladly supply them. They're shown, with their addresses in bold type. For convenience, send this coupon to the manufacturer.

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OIL AND GAS JOURNAL

May 1, 1961

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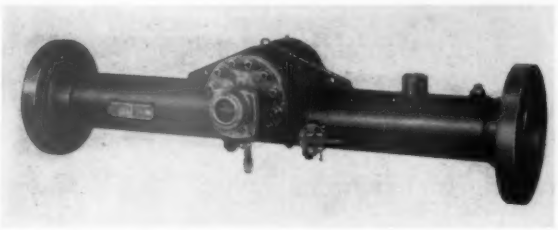

Simplicity stressed in flowmeter

THREE MODELS of a new flowmeter are available. The meters are a vortex-velocity type with an offset chamber in the side of a pipe in which a natural vortex is allowed to develop. This vortex rides on the main stream in the pipe. A linear relation exists between the number of revolutions of the vortex and the volume of the main flow. Rotation of the rotor is transferred to the outside by magnetic couplings.

Suited for either gas or liquid, the Whirl - Flo meter comes in three sizes: 6, 8, and 16 in. Each meter is fitted with an adjustable internal bypass which serves both as a range adjuster and as a calibrator. Source: **Rotron Controls Corp., Woodstock, N. Y., U.S.A.**

System permits long-distance oil-production control

AN ELECTRONIC SYSTEM has been designed to give operators a constant watch over widely separated wells or pipelines. The system will report any breakdowns, relay instructions from a central control point, and log production data.

Called an automatic logging, electronic reporting, and telemetering system (ALERT), the system makes use of an industrial data-transmission link to relay performance information and control instructions to and from individual wellheads, including pumping stations 50 miles or more offshore.

According to the developer, the system permits an operator of a computer to keep in constant touch with all the wellheads under control, making production changes instantly or according to a desired program to maintain a required daily output.

For operators of pipelines, the system provides up-to-date reports on pressures, pumping station failures, or power breakdowns.

The main component of the system is the central control station.

the start of long liner life

The reason more Mission Liners are sold than all other makes together is simple: On well after well they have been proved best. Mission quality and superiority don't depend on chance; they are the sum of many carefully attended to details.

Take heat treating, for example. The induction hardening process which Mission uses can be more carefully controlled to a precise depth and hardness. The hardening is uniform, with no soft or thin spots to wear quickly. In tolerances, concentricity of ID and OD, surface finish, hardness, and fit, Mission Liners must meet the most exacting standards. Quality is the word for Mission pump parts. So, for greater pump efficiency, choose all Mission parts, first choice of the industry.

specify Mission all the way for greater pump efficiency

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MISSION MANUFACTURING CO. P. O. Box 4209, Houston, Texas • Cable Address "MISSCO" Export Office: 30 Rockefeller Plaza, New York • In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • cable address "MISSOMAN"

It is equipped with a control panel which the operator supervises. It shows with a graphic display panel the oil field or pipeline network and is equipped with pushbutton controls, alarm printer, production logger, test-data logger, automatic typewriter, and paper-tape equipment.

A variety of transmission media can be used with the Model 130 equipment. These include very-high-frequency radio, telephone, or telegraph lines, submarine cable, or microwaves. Source: **Radio Corp. of America, 30 Rockefeller Plaza, New York 20, N. Y., U.S.A.**

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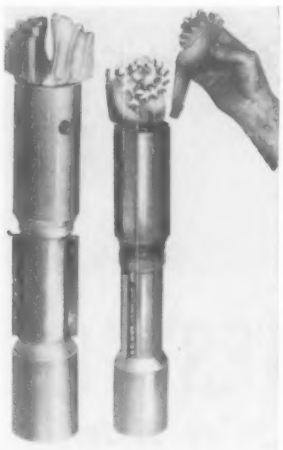
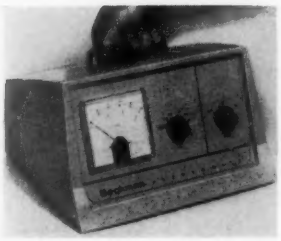


Rotary drill bits feature replaceable cones, blades

Both two and three-cone models will be available soon in a new line of replaceable cone bits (shown at right). Two, three, and four-way blades will all fit in the same subassembly of the new replaceable-blade bit shown. Initial sizes of both DWV bits will be 4¼, 4½, and 4¾ in.

In the cone type of bit, the ball-and-roller type of bearings can be replaced without returning the bit to the plant.

The cones and blades both fit into the same holder so the user need not change subs when changing from blades to cones or vice versa. If one section of a cone or blade wears out or breaks before the others do, only the one section needs to be replaced. Air course size can be changed any time by varying the hole size in the compression thimble. Source: **Varel Mfg. Co., 9230 Denton Dr., Dallas 20, Tex., U.S.A.**



Portable moisture meter

. . . now being marketed is designed to measure trace quantities of moisture in gases. Uses include monitoring gas in purge systems and gas dryers in laboratories, checking of water content in bottled gases, and monitoring of natural gas in research laboratories and pilot plants.

The Hygromite meter weighs 11 lb. and comes encased in plastic with a built-in carrying handle.

The instrument monitors water vapor continuously in ranges from 0-to-10 to 0-to-1,000 with an accuracy of ±5% of full scale in any of the ranges, the maker claims. Source: **Beckman Instruments, Inc., 2500 Fullerton Rd., Fullerton, Calif., U.S.A.**

TOGETHER FOR GOOD

Reilly Coal Tar Enamels and related primers, used together, provide the corrosion protection needed by underground metal structures. The Reilly hot enamel system is:

electrically insulated	oxidationproof
waterproof	stressproof
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In addition, Reilly coating systems offer ultimate longevity because they inherit the chemical inertness and stability of coal tar, from which they are made.

Specify Reilly hot-applied coal tar enamels and related primers for oil, gas and water pipelines.

REILLY ENAMEL AND PRIMER

Reilly Pipeline Enamel	Reilly Pipeline Primer	Reilly Redhead® Primer
Reilly Intermediate Enamel	Reilly QD Primer	
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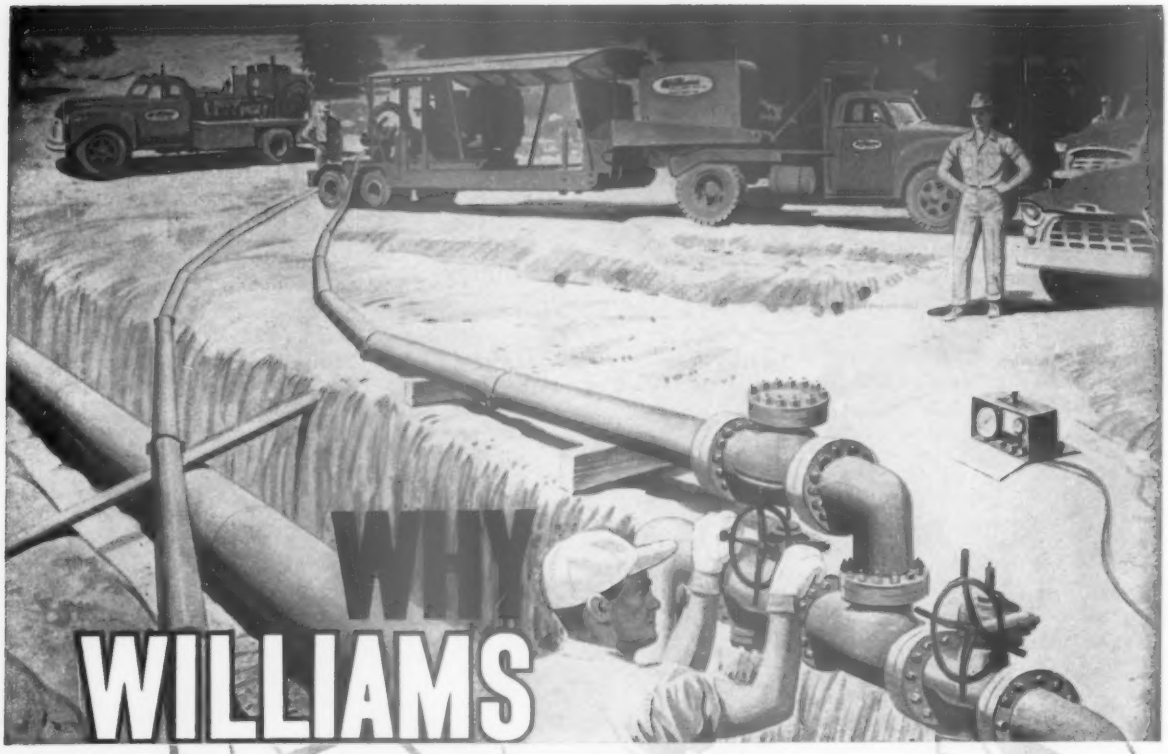

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costs a lot less than you'd think

YOU PROBABLY RECOGNIZE THE EXTRA SECURITY OF HYDROSTATIC TESTING; but you may have hesitated to use it because of its expense. However, cost per mile rates are not high... at least when we do the job.

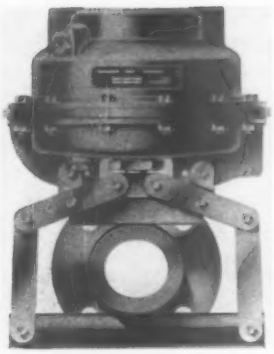
There are thousands of miles of reasons for this. For we have hydrostatically tested more miles of pipeline than all other companies combined. Our engineers have learned how to make advance surveys, program the jobs and supervise them personally. There's no lost effort, no added expense. And testing moves right along with construction.

You'll be surprised too at the caliber of equipment we put on your job, modern motorized fill units... high capacity pumps... quick action connections on pipe and hose... and numerous smaller improvements which we have developed over the years. *No other company offers you such complete hydrostatic testing service.*

Why not let us back up our boast about low costs. Call or write for a quotation on your next job.

Williams Pressure Service Company

2000 BECK BUILDING, SHREVEPORT, LOUISIANA Telephone 424-2678



Valve for abrasives, corrosives

. . . just announced is designed to control those types of fluids in locations considered too hazardous or inaccessible for manually operated valves. The Flex valve has a pipe-like body which is said to provide full capacity and unobstructed flow and will not plug. The maker claims it closes bubbletight even on small solids.

Body materials may be pure gum rubber, buna-S, buna-N, neoprene, butyl, and compounds of these. Connections include slipon and flanged types. Source: **Farris Flexible Valve Corp., 402 Commercial Ave., Palisades Park, N. J., U.S.A.**

•

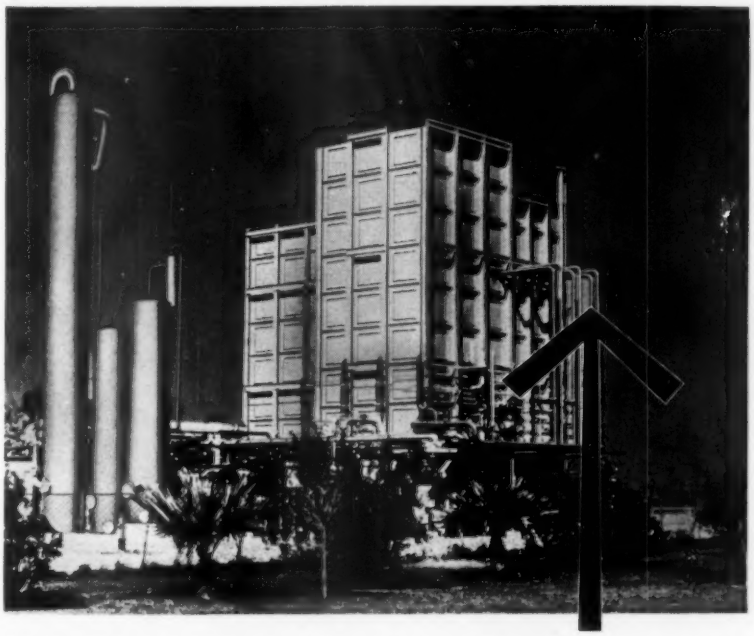
Switch for low pressure

. . . recently put on the market is designed to handle a maximum set pressure of 7 psig. Dead band is reported to be 2 in. of water and repeatable accuracy ±0.5%.

A Ni Span C capsular type of sensing element is used to reduce any change in the pressure set point by thermal reaction over the operating range of −65° to 300° F.

from ALCOA

good designs made better with aluminum



Alcoa Aluminum stands up at cryogenic temperatures in oxygen plant designed and manufactured by Air Products, Inc.

At this oxygen plant built by Air Products, Inc., Allentown, Pa., for production of organic chemicals, aluminum was the logical material for construction of cryogenic equipment. ALCOA® Aluminum alloys have the ability to maintain ductility and resistance to shock loading at extremely low temperatures. In fact, tensile and yield strengths actually improve in the cryogenic ranges without embrittlement. Add low cost and ease of fabrication—small wonder that aluminum is preferred for low-temperature process vessels and transportation equipment. The coupon will bring you more information.

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Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries.

☐ 68-10460 Process Industries Applications of Alcoa Aluminum
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NEW ISSUE

April 20, 1961

$35,000,000

Transcontinental Gas Pipe Line Corporation

First Mortgage Pipe Line Bonds, 5% Series due 1981

(Due November 1, 1981)

Price 99%

Plus accrued interest from May 1, 1961

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Safe: vapor and moisture tight. Always cool. Can't burn mechanic's hands. Approved by safety engineers.

Easy to use: light weight. Small diameter. Easy to grip or hang.

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In 6, 8, 13, 15 and 30 watt sizes. 18" handles available.

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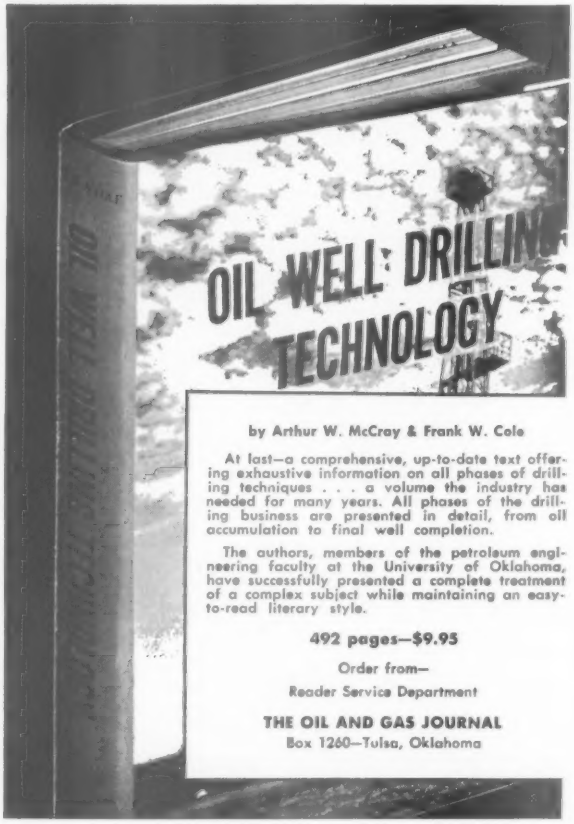
Originator of aircraft fluorescent ballast systems



by Arthur W. McCray & Frank W. Cole

At last—a comprehensive, up-to-date text offering exhaustive information on all phases of drilling techniques . . . a volume the industry has needed for many years. All phases of the drilling business are presented in detail, from oil accumulation to final well completion.

The authors, members of the petroleum engineering faculty at the University of Oklahoma, have successfully presented a complete treatment of a complex subject while maintaining an easy-to-read literary style.

492 pages—$9.95

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THE OIL AND GAS JOURNAL

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A single-pole, double-throw, snap-action type, the switch is enclosed in a cylindrical housing and rated at 7 amp. at 115/230 volts a.c. Standard pressure port size is ¼-in. N.P.T. male fitting. Source: **Pamar Electronics Co., Inc., 1 Tenakill Park, Cresskill, N. J., U.S.A.**

•

Diesel-powered marine tractor

Barges, towboats, work boats, and similar craft can be powered with a new diesel-powered marine tractor now being produced with a rating of 58 hp. The engine is a radiator-cooled modified industrial type.

Features of the H5DM-3-53 Harbormaster tractor include outboard type of maneuverability with 360° propeller-thrust steering. The outboard drive section elevates 90° up to the deckline so it can be repaired and maintained.

A 24 by 22 propeller drives the unit. It is protected by a shear pin. Source: **Murray & Tregurtha, Inc., 80 Hancock, Quincy 71, Mass., U.S.A.**

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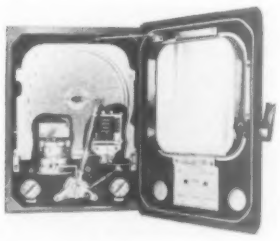
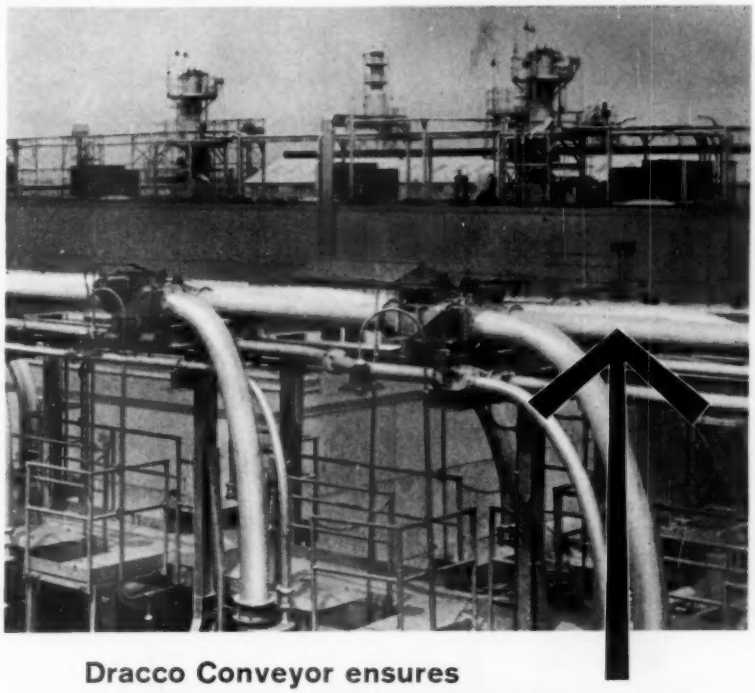


Pneumatic recording controller

. . . recently announced is claimed to provide good frequency response which is essentially flat to over 300 cycles per minute, low air con-

from ALCOA

good designs made better with aluminum



Dracco Conveyor ensures contamination-free handling of polyolefins

Polyolefins, having stringent specifications for purity, require a special type of bulk handling. That's why this network of Dracco's Airstream Conveyor Systems incorporates miles of ALCOA® Aluminum piping. It's a multiphase system designed by Fuller Company's Dracco Division for Phillips Chemical Co., leading producer of high-density polyolefins. Aluminum piping protects product purity, avoids unwanted color. With aluminum, there's no maintenance inside or out; superior heat-transfer ability cools conveying gases. Perhaps aluminum can improve your good design. For more information, please send the coupon.

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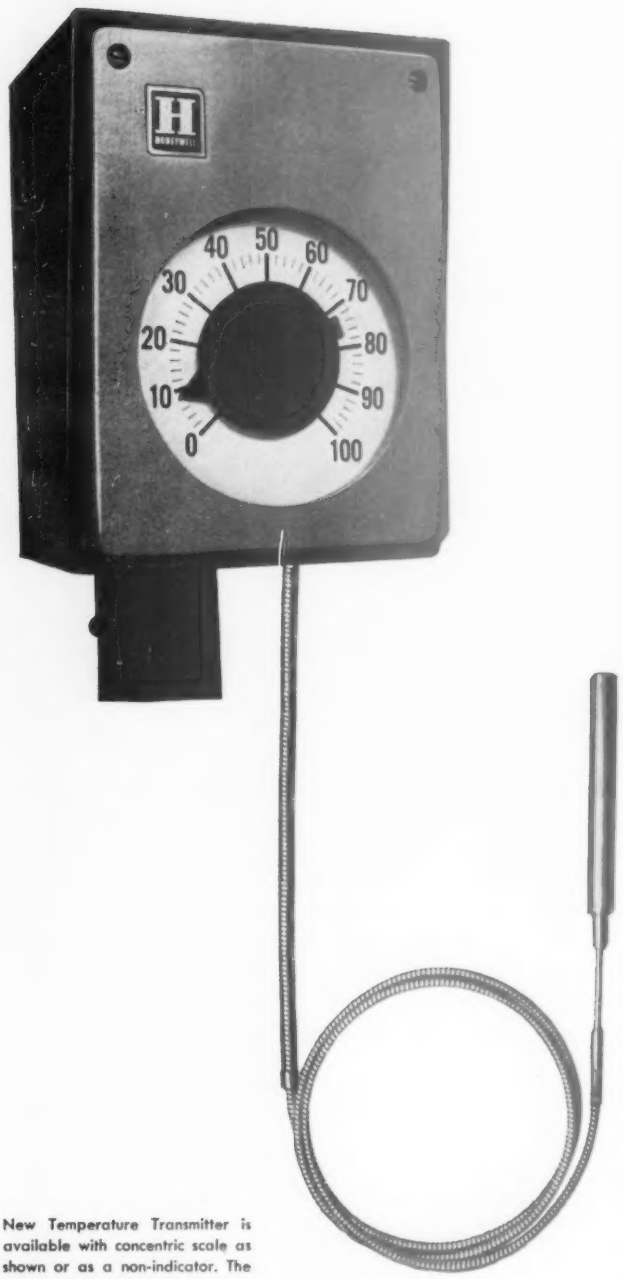
☐ 34-10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
☐ 68-10460 Process Industries Applications of Alcoa Aluminum

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

NEW TEMPERATURE TRANSMITTER

offers thermal system options with ranges from −125° to 1000°F



New Temperature Transmitter is available with concentric scale as shown or as a non-indicator. The unit transmits with calibrated accuracy of ±0.5% of full scale, and indicates within ±1.0% of full scale.

Completely new, completely flexible, the new Honeywell Temperature Transmitter gives you a choice of either gas or mercury thermal system plus a wide selection of measuring bulb styles. Die-cast aluminum case is 4″ by 7″ by 9″. Concentric scale is 8½″ long.

New built-in rebalancing capsule automatically compensates for changes in ambient temperature. Two-way overload protection covers 100% of span. Maintenance is greatly simplified by modular construction which lets you remove any major component by loosening two screws. All field adjustments are easily accessible, and a self-locking feature prevents upset after calibration adjustments are made.

Transmitter Features: Gas (—125° to 800°F) and mercury (—40° to 1000°F) actuated thermal systems with bulbs for any application. Mount on pipe welded to flow line, or on bracket that clamps on the hex head of the socket. Vibration resistant thermal system means accurate measurement on vibrating flow lines.

For more complete details on the new Temperature Transmitter, call your nearby Honeywell field engineer. Or write for *S630-1*. MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa. In Canada, write Honeywell Controls, Ltd., Toronto 17, Ontario.

Honeywell

First in Control

SINCE 1885

HONEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.

sumption of less than 0.1 s.c.f.m., high exhausting capacity of over 3 s.c.f.m. at a 1-psi. pressure drop, high tolerance to shock, and high-temperature stability.

The Series 532 controller comes with any of four modes of control. It can be used with the maker's measuring elements for control of pressure, temperature, flow, humidity, or differential liquid level.

The proportional controller model is said to be easily adjustable from 0 to 400%, direct or reverse acting. The proportional-plus-reset model is adjustable from 0.1 to 100 repeats per minute, with the same 0-to-400% proportional band adjustment.

The instrument case measures 14¾ by 10¾ in. Recording is on an 8-in. round chart. Source: **Bristol Co., 117 Bristol Rd., Waterbury 20, Conn., U.S.A.**

•

Flexible joint for cold pipe

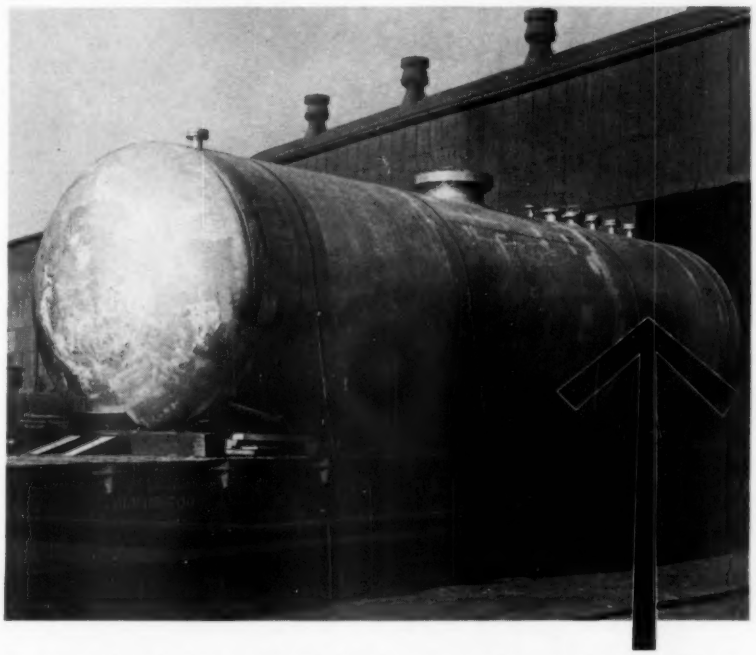
. . . handling such fluids as liquid oxygen, other liquefied gases and chemicals, and petrochemical oxidizers is available for temperatures from −325° to 275° F. Potential uses include pipe-expansion or contraction joints. Flexible metal loading arms, and swivel joints.

Design features listed for the joint include both gimbal and swivel movement, a sealing element that carries no mechanical loading yet is pressure sealing and self-adjusting as a result of internal fluid pressure. Mechanical loading and retention of the movable ball end of the joint are accomplished outside the seal in areas least subject to extreme internal low temperatures, the maker says.

The Featherweight Series joint comes in sizes from 2 to 12 in. with welding or flanged ends for 200-psi. w.p. Source: **Barco Mfg. Co., 500 N. Hough, Barrington, Ill., U.S.A.**

from ALCOA

good designs made better with aluminum



Graver tank for rocket fuel prevents contamination, reduces general maintenance

Built by Graver Tank & Mfg. Co., East Chicago, Ind., division of Union Tank Car Co., this aluminum pressure vessel stores rocket engine fuels for a famous eastern aerospace contractor. It was constructed for a design pressure of 45 psi, and was welded automatically. Aluminum prevents product contamination, resists corrosion, costs less to maintain. Whether product storage is an intermediate or final step in your operations, tanks of ALCOA® Aluminum will help cut costs and preserve product purity. Send the coupon for more information.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, 826-E Alcoa Building, Pittsburgh 19, Pa.
Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries.

- ☐ 34-10197 Aluminum Pipe and Fittings
- ☐ 34-10418 Alcoa Unitrace: Combines Piping and Tracing in One Unit
- ☐ DD-514 Alcoa Duotrace Technical Report
- ☐ 68-10460 Process Industries Applications of Alcoa Aluminum

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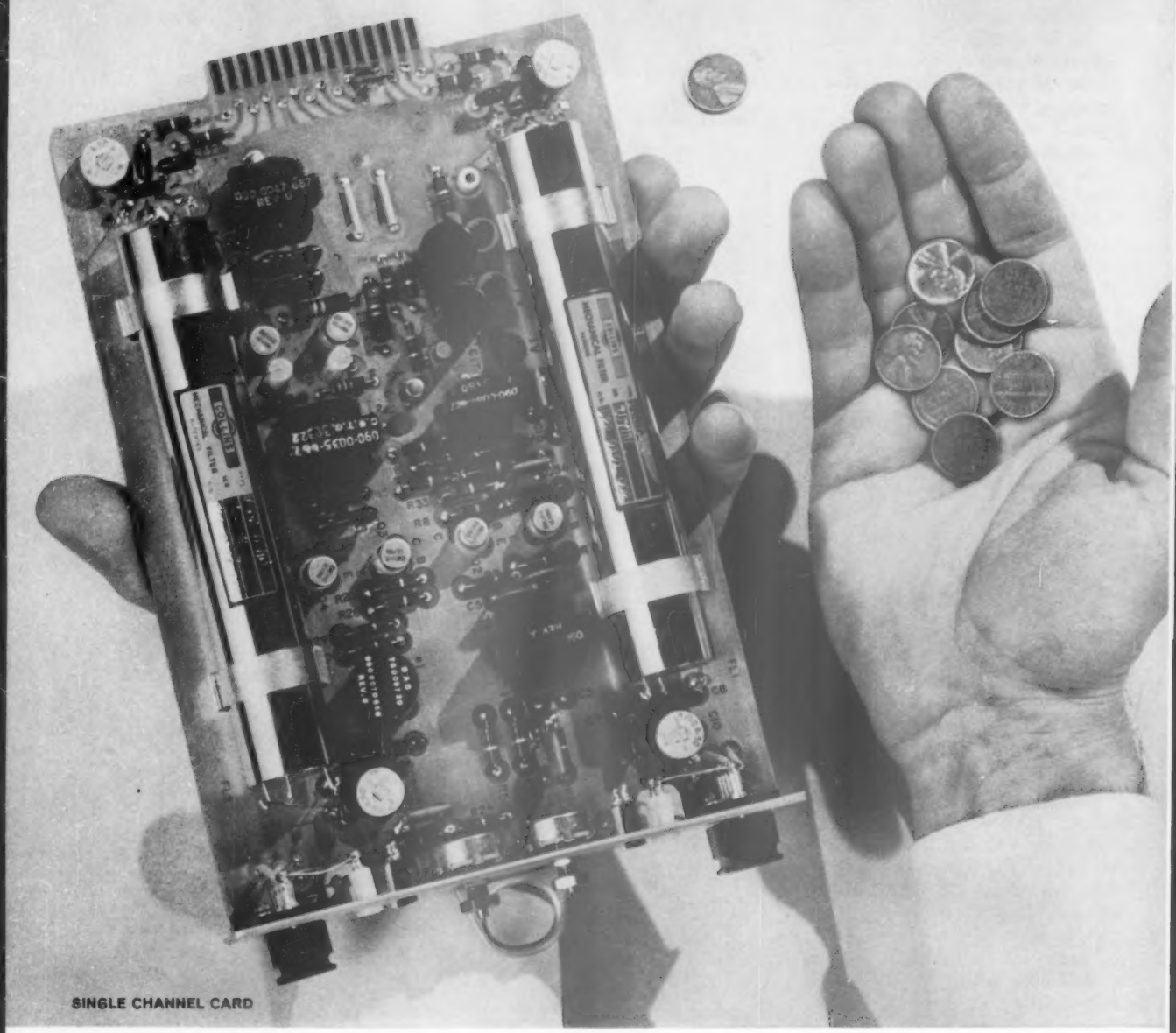
CUTS POWER COST **90%**... SPACE BY 80%



SINGLE CHANNEL CARD

NEW COLLINS TRANSISTORIZED CARRIER...UP TO 600 CHANNELS

Now... the freedom of maintenance and reliability inherent in transistorized equipment, at a saving of up to 90% in power and 80% in rack space over tube equipment. This is Collins new MX-106 fully transistorized carrier. Either in microwave, wire or cable systems — or any combination of these — the new multiplex is compatible with Collins MX-103, Western Electric L-Type, CCITT, and other carriers. Its design permits easy and economical expansion to meet changing requirements. For details, write Collins Radio Company, Texas Division Sales, 1930 Hi-Line Dr., Dallas 7, Texas.

COLLINS MICROWAVE AND CARRIER

COLLINS

COLLINS RADIO COMPANY • DALLAS, TEXAS • CEDAR RAPIDS, IOWA • BURBANK, CALIFORNIA

New mobile radio voice scrambler

Privacy over both FM mobile and point-to-point radiotelephone systems is now claimed to be possible with a new device now on the market, called a Radio Scrambler. The Model 206 device is transistorized and self-contained in a control head. A universal mounting bracket permits it to be mounted under a dash, on a bulkhead, or on a desk.

When the device is used with two-way radio equipment, the normal radio-telephone volume and squelch controls are used. A control on the front panel of the unit permits the operator to select either clear or scrambled communication. Miniature lamps confirm the control-knob position to indicate the clear or scramble mode of operation. Source: **Delcon Corp., 943 Industrial Ave., Palo Alto, Calif., U.S.A.**

•

Interchangeable hangers in wellhead-equipment line

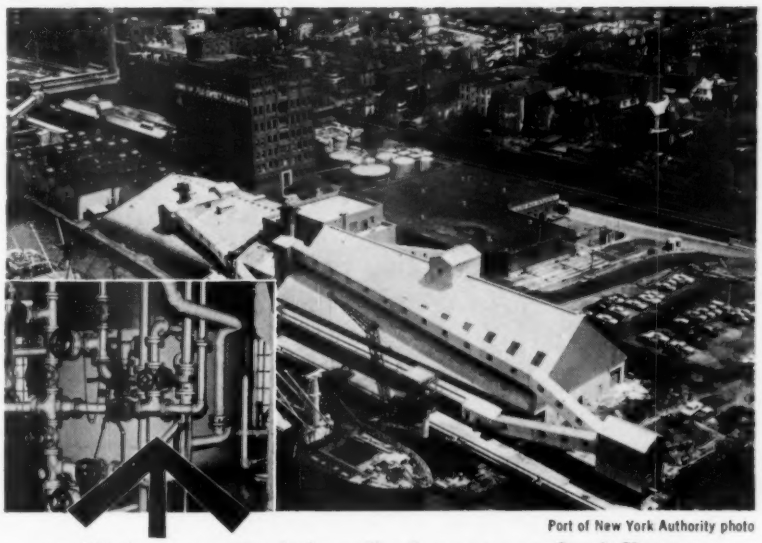
Single or multiple tubing strings can be suspended either by slips or by threaded mandrels in a line of wellhead equipment developed recently for tubingless completions. Single, dual, and triple tubingless completions can be easily handled by 10-in. casing heads. Quadruple completions can be accommodated with 12-in. casing heads.

The lower bowl segment of an individual hanger is the same item and can be used with either slips or threaded suspension. Only slips and a packing element are necessary to change from threaded to slip suspensions.

The hanger bowl will pass 4⅛-in. centralizers on either side. Mandrels or slip suspension hangers are available in the design. Source: **Alco Products, Inc., 444 Bank of the Southwest Bldg., Houston, Tex., U.S.A.**

from ALCOA

good designs made better with aluminum



Port of New York Authority photo

. . . with low-cost piping that ensures fast flow, no metallic contamination handling liquid sugar for Refined Syrups & Sugars, Inc.

The piping system you see here makes good use of the natural corrosion resistance of aluminum to handle liquid sugar at Refined Syrups & Sugars, Inc., Yonkers, N.Y. The major benefits: no product contamination, long service life and low maintenance. Actually, the use of aluminum pipe insures palatable sugar solutions, especially in final refining stages. Aluminum's corrosion resistance contributes to the uniform high quality of the sugar, guaranteeing freedom from metal pick-up. Low friction factor speeds syrup flow . . . and initial cost is surprisingly low. You see once more how ALCOA® Aluminum adds major improvements to a basic good design. See how it can do the same for your designs. Simply mail the coupon.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, 826-E Alcoa Building, Pittsburgh 19, Pa.
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- ☐ 50-19415 Welding Alcoa Aluminum

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Company_____
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FOR RELIABLE, UNFAILING ELECTRIC OPERATION... It's the HYDRAMOTOR® valve, designed by General Controls for lines up to 12″ diameter and offering the advantages of single-unit, sealed-in-oil hydraulic ram power that's controlled by simple 2-wire circuitry.

Electro-hydraulic power operation eliminates complicated linkages and gearing, as well as need for outside air or gas supply—and it's fail-safe because the valve returns to safe position by spring force if power is interrupted. Ideal for use in cold weather, the Hydramotor is available in a low temperature unit designed for ambient conditions to –40°F.

BE QUALITY SURE...ALWAYS SPECIFY GENERAL CONTROLS

GENERAL CONTROLS

Automatic Controls for Product or Process

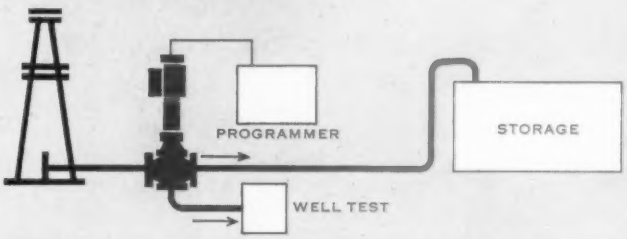
Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada

Nine Plants — 44 Factory Branch Offices Serving
The United States, Canada and Western Europe

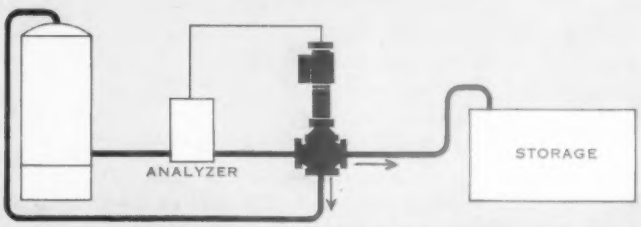
HERE'S THE VALVE THAT SOLVES YOUR OIL FIELD CONTROL PROBLEMS...

THREE BASIC TYPES of hermetically sealed Hydramotors are available in dust proof, drip proof, explosion proof and weather proof models: **Standard Hydramotors** provide open, closed, or in-between positioning. **Three-way 2-position units** provide for diverting flow from a common source to either of two outlets. **Three-way 3-position Hydramotors** carry flow from well to production, to test sampling or secondary tank, or to shut off. Hydramotor valve actuators are manufactured in a range of 180 to 6000 pounds of stem thrust and in a stroke range of ⅝" to 4½". Valve bodies of cast iron, cast bronze, cast carbon steel, stainless steel and other alloys are available in 150, 300, 600, 1500, 3000 and 6000 lb. ASA ratings.

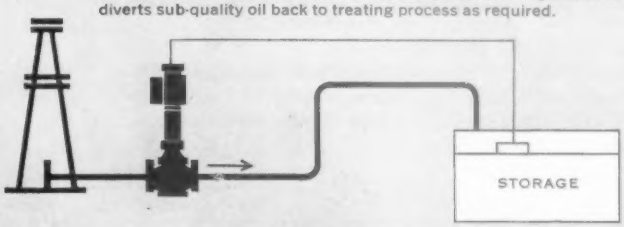
Write today for complete information. Ask for Bulletin 608.338.



WELL TESTING, 3-way 2-position Hydramotor valve samples rate and quality of flow on command or through programming equipment. The 3-way 3-position Hydramotor not only diverts flow but also provides full shut off for well shut in.



AUTOMATIC CUSTODY TRANSFER, 3-way 2-position Hydramotor diverts sub-quality oil back to treating process as required.



TANK SWITCHING, a standard Hydramotor controls level in storage tanks.

What's NEW

... in literature

Direct-connected centrifugal fans

... along with propeller and centrifugal-power roof ventilators, wall-mounted and square-panel propeller fans, and steam, hot water, electric, and gas-fired-unit heaters, are featured in eight-page Bulletin DB7-102. It contains illustrations, ratings, specifications, and descriptive copy. Included are illustrations and capacities covering small direct-connected and belted Util-A-Set centrifugal fans. Source: **Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago 41, Ill., U.S.A.**

Custom-molded rubber products

... bulletin (four pages) is now avaliable, free for the asking. It illustrates and describes mixing, extruding, fabric coating, and molding processes. The literature piece includes a number of components to meet varying conditions of heat, cold, friction, and contact with corrosive liquids. Source: **Tulsa Rubber Co., Box 4683, Tulsa, Okla., U.S.A.**

Liquid-blending-systems

... bulletin details Vari-Flo proportioners and new concepts in continuous-line blending. Following a general discussion of line-blending advantages, Bulletin 650 uses illustrations to explain operating principles of the Vari-Flo units, which form the primary components of each proportioning system. A schematic layout is used to describe the purpose and function of various secondary components from which packaged systems are engineered to meet specific job requirements. Source: **Blackmer Pump Co., 1901 Century Ave., Grand Rapids 9, Mich., U.S.A.**

Package boilers

... have capacities ranging from 10,000 to 80,000 lb. of steam per hour and design pressures from 200 to 250 psi. A 10-page literature piece offers photographs of the Series P boiler, along with design information, component parts and features, advantages, and selection tables. Source: **Power Div., Bros., Inc., 1057 Tenth Ave., S.E., Minneapolis 14, Minn., U.S.A.**

Adjustable-speed drives

... for pipeline pumping operations are discussed in an eight-page booklet now available. Booklet 5560 is illustrated with application diagrams, efficiency curves, and mechanical features of RectiFlow and MagnaFlow adjustable-speed drives. Source: **Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., U.S.A.**

Fracture conductivity

... a measurement of the amount of fluid which can flow through a given fracture under a given set of conditions, is the subject of a newly issued 20-page technical report. Complete with a series of graphs, the publication details partial monolayer propping of fractures and field applications of data. One chapter deals with laboratory data and is broken down into discussions of: (1) equipment used in fracture-conductivity tests; (2) effect of the hardness of the formation on frac-

Practical ideas to help you Stop CORROSION

CAN YOU PROFIT BY THESE EXPERIENCES?

Corrosion of pipe and other underground structures continues to cost industry thousands of dollars—unnecessarily. Are you letting questions or doubts stop you from using **economical** cathodic protection? Here are some of the recent satisfactory jobs performed by CSI engineers.

116 Oil Wells (West Texas). 2 casing leaks had resulted from external corrosion in this field. CSI ran current requirement tests, then installed rectifiers and graphite anodes on each well. Cost was only $300 to $350 per well.

Pipe Line (Southern Oklahoma). This line is operated by a major company. A cathodic protection system using 15 rectifiers was installed. CSI furnished all materials, labor, 15-foot augers, ditchers and other necessary equipment.

30 Oil Wells (Western Kansas). CSI determined current needed to stop corrosion; then installed 6-ampere-output rectifiers on a turnkey basis. Cost: $300-$350 per well.

Housing Unit Piping (Ohio). The builder of this housing unit wanted to prevent leaks and lengthen the life of the underground piping system. CSI recommended and installed a protective system using magnesium anodes. Anodes were used to lessen stray-current danger to nearby structures.

29 Oil Wells (West Texas). One casing leak had already occurred in this field. CSI installed protective systems using special new rectifiers that deliver almost constant current output despite heavy rains or dry periods.

Pipe Line (West Texas). Experience indicated that leaks would become an increasing problem. Protection was required. CSI installed 600 magnesium anodes in only 10 days.

CSI engineers pioneered and are acknowledged experts in the cathodic protection of underground structures. You'll find them helpful and eager to discuss your corrosion problems. They offer engineering and installation services, plus brand-name supplies at competitive prices.

CSI

CORROSION SERVICES INCORPORATED

Cleveland 13, Ohio
1309 Washington Ave.
Tel. CHerry 1-7795

General Office: Tulsa, Okla.
Mailing Address:
Box 787, Sand Springs, Okla.
Tel. Circle 5-1351

Noel M. Champion *(left), Chief Engineer, Armour Agricultural Chemical Company, discusses a technical problem with* Robert L. Kietzman, *Sales Engineer, The Cooper-Bessemer Corporation, St. Louis District Office.*

How Cooper-Bessemer service helps keep the ammonia flowing

At Armour Agricultural Chemical Co., Crystal City, Missouri, nine Cooper-Bessemer compressors play key roles in the manufacture of ammonia products. Round the clock, for five years, these units have given exceptional performance under the rigors of such problems as handling pressures up to 9000 psi.

The performance of these C-B compressors has been backed by Cooper-Bessemer engineers in the St. Louis area and in Mt. Vernon, contributing helpful service for these high-pressure operations.

Cooper-Bessemer engineers will gladly help *you* plan compression facilities, and demonstrate how this unique service works for your benefit. Call the nearest office.

BRANCH OFFICES: Grove City • New York • Washington • Gloucester Pittsburgh • Mount Vernon • Detroit • Chicago • Minneapolis • St. Louis Kansas City • Tulsa • New Orleans • Shreveport • Houston • Greggton • Dallas Odessa • Pampa • Casper • Seattle • San Francisco • Los Angeles

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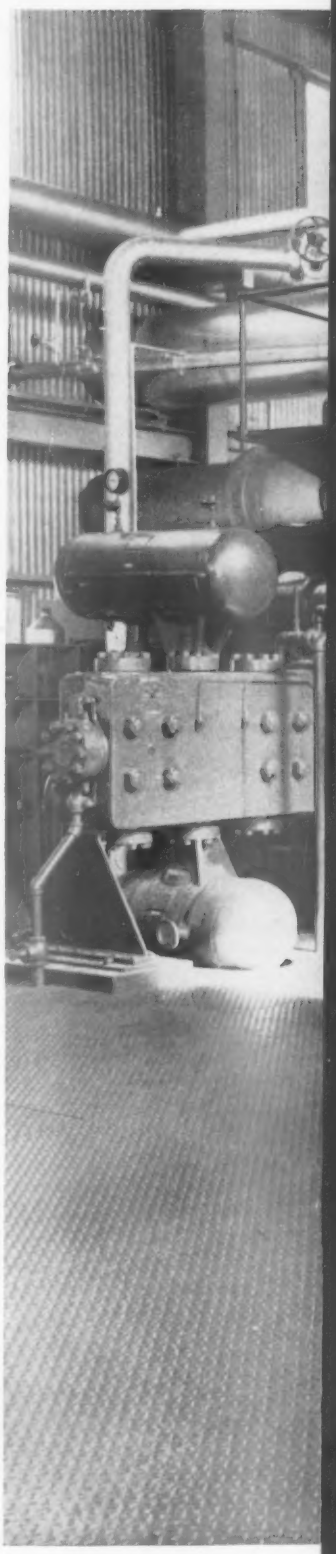
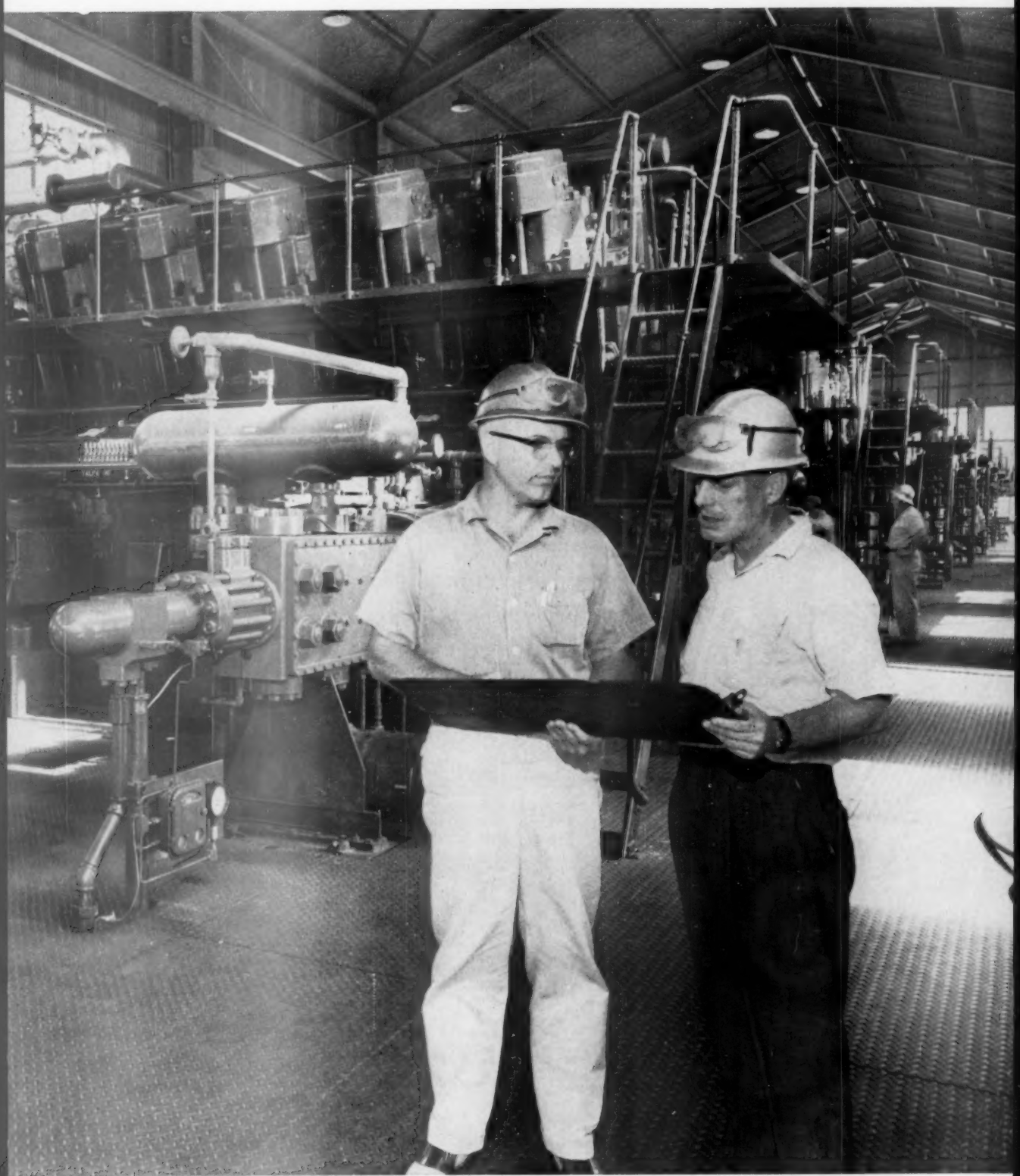
GENERAL OFFICES: MOUNT VERNON, OHIO

COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINES: GAS - DIESEL - GAS-DIESEL
JET-POWERED GAS TURBINES





Noel M. Champion *(left) and* Thomas H. Ferebee, *Supt. Ammonia Plant. In background are two GMWA-10, four GMWA-8 and one GMWA-6 engine driven compressors for compression of air, natural gas, synthesis gas and ammonia. Armour also has two FM compressors for ammonia recirculators.*

ture conductivity; and (3) effect of mechanical pumping, temperature, and well fluids on propping agents. Source: **Dowell Division of the Dow Chemical Co., Box 536, Tulsa, Okla., U.S.A.**

Multipoint-controller

. . . publication features the Thermo Electronic controller in eight pages. Information is given on various applications of the bridge or potentiometer circuits, installation and operation, and maintenance. The catalog is illustrated with photos to show the instrument controlling various machines and processes. Specifications cover characteristics, including the instrument's use with conventional sensing elements. Source: **Thermo Electric Co., Inc., Saddle Brook, N. J., U.S.A.**

Turbine-pump calculations

. . . and 84 performance curves on regenerative centrifugal turbine pumps of end-mounted design, are contained in a new 36-page booklet. Included are seven "family" curves for quick identification of the performance relationship between models of a given series. The booklet also deals with motor selection, NPSH calculation, specific-gravity conversion, and viscosity conversion. Source: **Turbine Pump Div., Roy E. Roth Co., 2470 Fourth Ave., Rock Island, Ill., U.S.A.**

Piston-ring selection

. . . booklet covers selection and application of piston rings in large-bore diesel and gas-burning engines. Available for the asking, the eight-page publication outlines suggestions for common problems encountered in selecting top and intermediate compression rings, and oil-control rings. The booklet also shows how to compensate for poor groove condition, excessive ring wear, blowby, tapered cylinders, inadequate lubrication, and ineffective scraping. Source: **Piston Products, Inc., 7324 N. Lawndale Ave., Skokie, Ill., U.S.A.**

Transmit data by dial telephone

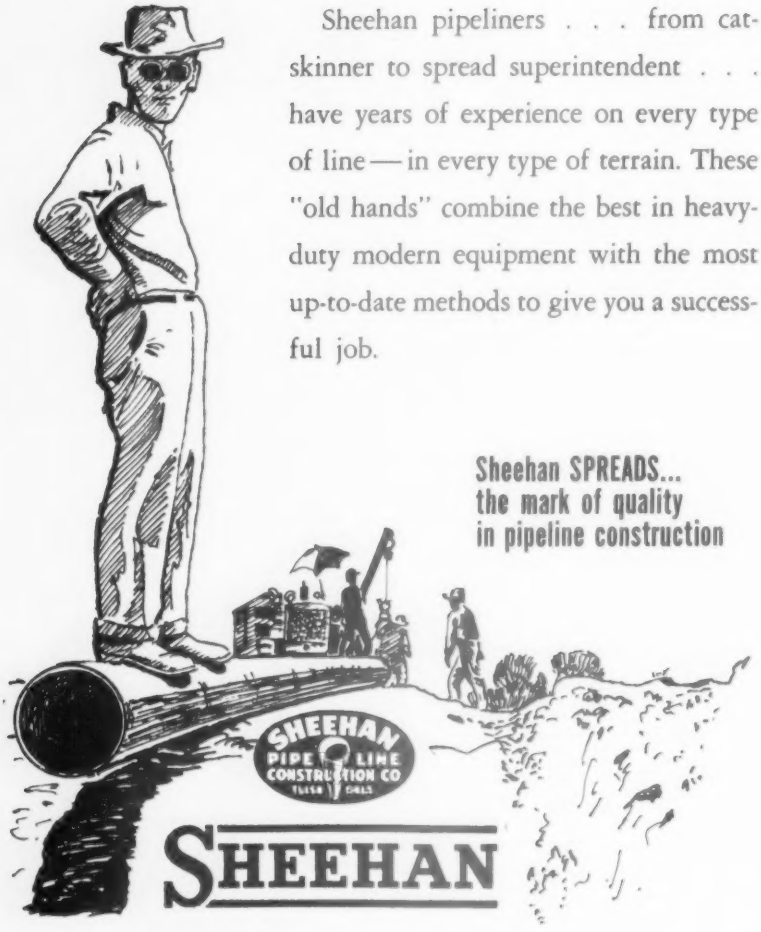
. . . as detailed in a new bulletin describing the "Dial-o-verter" system. The system functions with the Bell System Data-Phone 200 to send and receive data, at high speed, to and from any number of remote locations, via the regular dial-telephone network, or over private lines. The eight-page bulletin includes photographs of a magnetic-tape terminal and a paper-tape terminal, since the system can transmit in one medium, (paper tape, punched cards, or magnetic tape), and receive in another medium. Source: **Digitronics Corp., Albertson Ave., Albertson, L. I., N. Y., U.S.A.**

Hand tool removes rust, scale

. . . paint, and hard deposits at the touch of a trigger, according to a newly released two-page literature piece. Powered by a 12,000 r.p.m. motor, the Revo-Tool is said to sheer off scale, chemical deposits, etc., at up to 160 sq. ft. an hour. The bulletin offers typical performance features, specifications, and photos. Source: **G. H. Tennant Co., 701 N. Lilac Dr., Minneapolis 22, Minn., U.S.A.**

pipeliner . . .

. . . the "make-or-break" factor in pipelining



Sheehan pipeliners . . . from cat-skinner to spread superintendent . . . have years of experience on every type of line — in every type of terrain. These "old hands" combine the best in heavy-duty modern equipment with the most up-to-date methods to give you a successful job.

Sheehan SPREADS... the mark of quality in pipeline construction

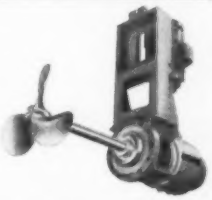
NATIONAL BANK OF TULSA BUILDING
TULSA, OKLAHOMA

INSTALL IT–THEN FORGET IT

Here's a big-tank mixer you can count on. Philadelphia's precision-hobbed gear reducer is self-lubricating, perfectly matched; runs for years without maintenance. Tight? You bet. Philadelphia has the surest seal you can find on a side-entering mixer — right up against a supporting bearing, where shaft runout and deflection are at a minimum. And it's a simple job to replace the seal, if necessary—or to repack the optional stuffing box. Lock the positive shut-off collar in place, then make the change without losing a drop of product. Your Philadelphia mixer can be back at work in less than 30 minutes.

For reliable month-after-month, year-after-year operation, specify Philadelphia. Philadelphia Mixers do what they're sold to do. Philadelphia Mixers mix . . . and keep on mixing.

Get Facts on agitator performance, sizing, positioning. *Shaft Seal* section describes replacement of mechanical seal, details stuffing box repacking. Read how Philadelphia Side Entering Mixers deliver twice the power, take up just half the space. Request 12-page Bulletin PSE-60 on your letterhead today.



PHILADELPHIA MIXER

DIVISION OF PHILADELPHIA GEAR CORPORATION
King of Prussia (Suburban Philadelphia), Pennsylvania

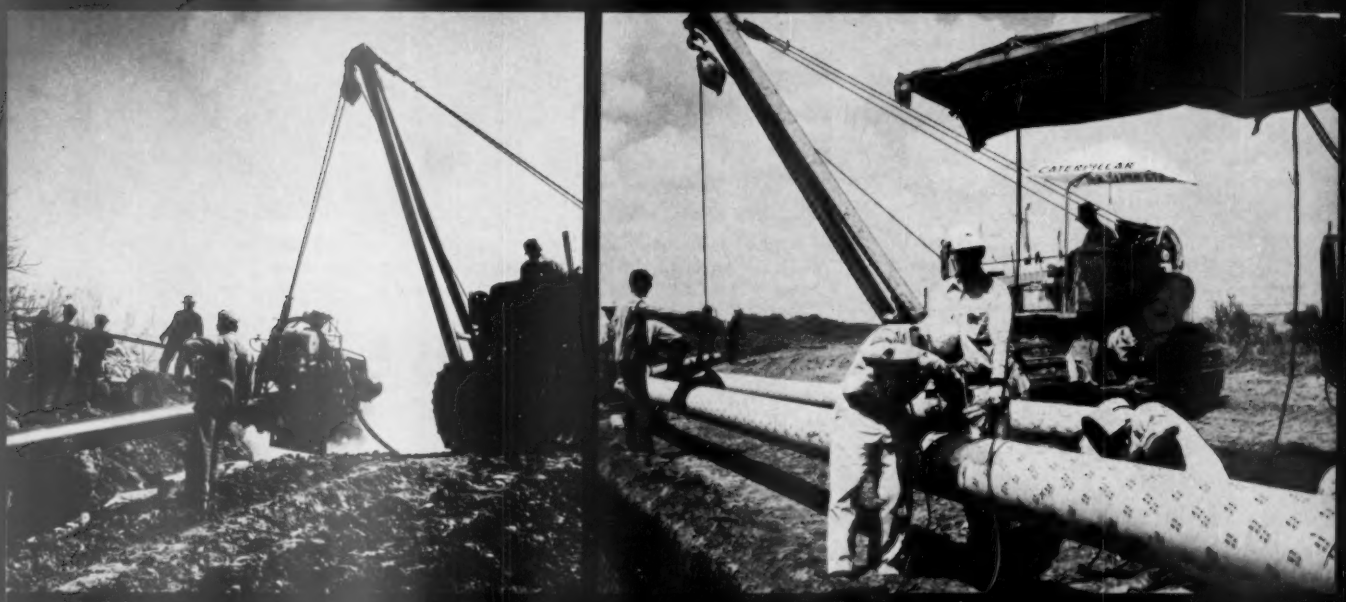
ASK ANY ENGINEER / GEARS ARE THE HEART OF A MIXER

AGMA MEMBER

J.L

SUPPLY

Quality checks pay



off on the right-of-way

Additional Jones & Laughlin tests and advanced mill practices guard the quality of J&L line pipe. The pipe is easy to bend, line up, and weld.

Ask for technical data and prices on J&L line pipe, Rockwell plug valves, and Taylor Forge welding fittings. If it's sold by J&L it's the best available. Call your local J&L Supply man—or write us at Tulsa, 1423 Sheridan Rd.

Jones & Laughlin Supply Division—Tulsa

▶ ▶ ▶ Equipment Men Notes

Gardner-Denver promotes four

. . . at a recent meeting of the board of directors, reports Gifford V. Leece, president of the Quincy, Ill., firm. E. V. Erickson, former executive vice president, has been elected senior vice president.

C. H. Rieman, previously vice president and general manager of the Denver division, has become executive vice president. Robert H. Meystre, treasurer, has been elected financial vice president and treasurer. William H. Miller, formerly controller, has been elected vice president and controller.

Cook, Wilbur are co-managers

. . . of Ideco Division of Dresser Industries, Inc. according to Geo. W. (Jack) Walton, president.

W. O. (Bill) Cook, senior vice president, previously was in charge

W. O. Cook

G. G. Wilbur

of engineering, manufacturing, and the division's Beaumont plant. He joined Ideco in 1934. Gordon G. Wilbur, another vice president and assistant to the president, was in charge of export. He joined Ideco in 1939.

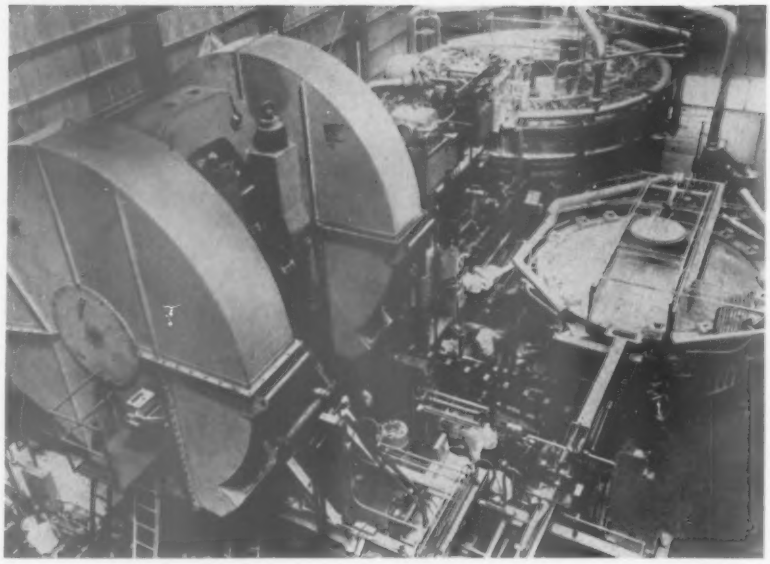


Photo shows the extrusion press in the foreground and two rotary furnaces in the background. Housings on the press cover two drive gears for the crankshaft. These gears are about 15 ft. in diameter and weigh 35 tons each.

Big Press Speeds Extrusion

A NEW TUBING MILL using a vertical extrusion press can turn out seamless-steel tubing at triple the pace of other domestic processes.

Gulf States Tube Corp., subsidiary of Michigan Seamless Tube Co., recently displayed the new $5-million mill at its Rosenberg, Tex. plant. The mill's principal output will be heat exchangers and condensers, but it will also manufacture odd-size oil-well tubing.

The 1,800-ton mechanical press can extrude 150 billets hourly and produce 80 to 260 ft. of hollows per minute. The fully automated mill handles the steel by mechanical means from the time the raw bar stock is moved onto conveyers at one end of the building until it's turned out as finished tubing at the other end ready for shipment.

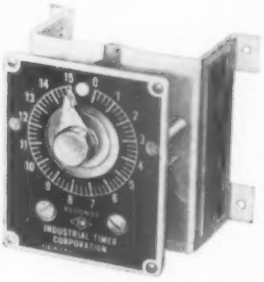
The mill does not fabricate the tubing for use in the field. The new hot-mill operation complements and expands the company's cold-draw mill at the 3-year-old Rosenberg plant near Houston.

ANNUAL SALES MEETING of W. C. Norris Division of Dover Corp., held recently, was divided with half of the sales staff meeting in Tulsa and the other half in Houston. Attending the Tulsa session were, front row, from left: K. M. Cook, Cecil Fair, Joel Little, Earl Carpenter, Wm. L. Butler, Ed Scholl, J. A. Getty, Bill Peterson, Jim Chambers, and R. L. Preston. In the back row are: J. A. Schaff, G. W. Davidson, D. P. Hagaman, LeRoy Mitchell, A. L. Ethriedge, Clint Cross, Kenneth Hance, W. C. Tolleson, Dan Coates, Stan Hill, Gerald Holleyman, Bill Black, and J. E. Giles.

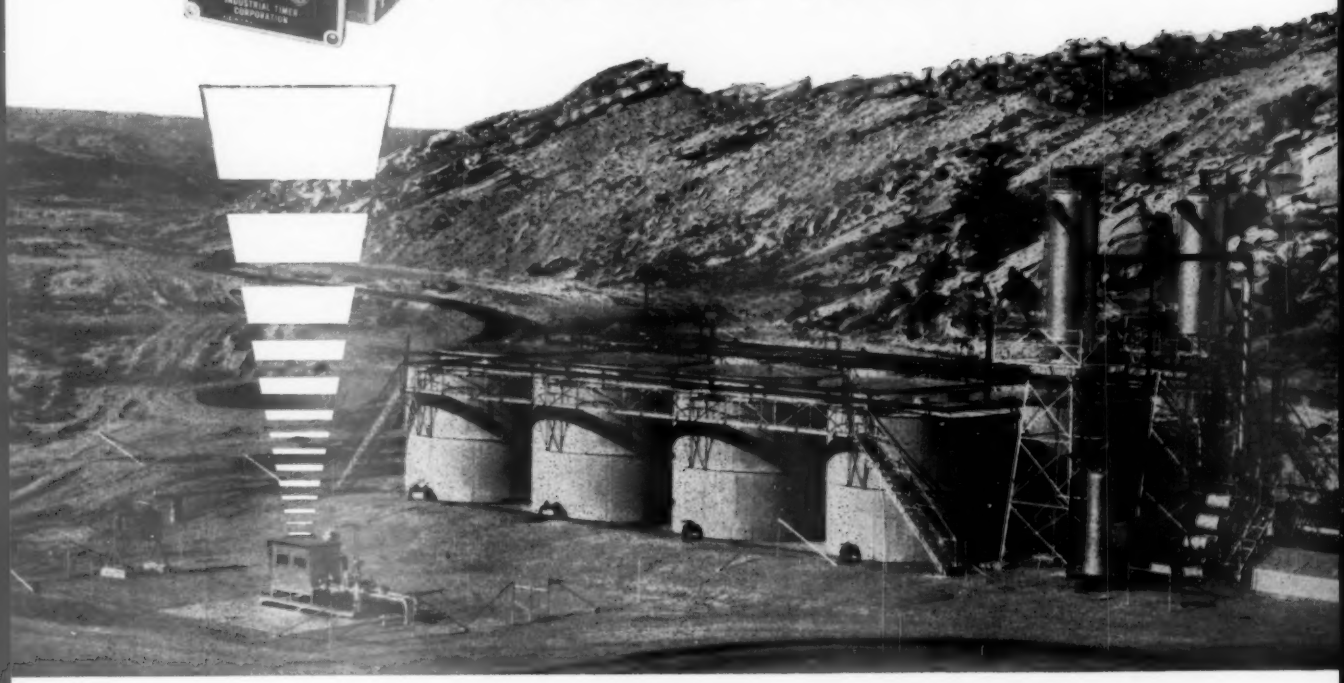
Oil Well Supply Division names

. . . Harry R. Brown as store manager at Hennessey, Okla., while appointing five new field representatives: B. L. Bristow, at Hennessey; Jimmy C. Mills, Morgan City, La.; Herman L. Hatfield, Graham, Tex.; James R. Harris, Ponca City, Okla.; and Doyle E. Richeson, Lindsay, Okla.

Three other appointments were announced by National Tube, another division of U. S. Steel Corp. James G. Morrison becomes manager of sales, New York district office; Paul C. Ely, general manager



AN INDUSTRIAL TIMER TIME DELAY TIMER

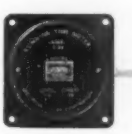


at the heart of LACT *automatic crude oil handling*

In less than 5 years the "Lease Automatic Custody Transfer" system has become one of the significant advances that automation has brought to the oil fields. Unknown a little over 5 years ago, there are now more than 200 National Tank Company LACT systems speeding the handling of crude everywhere in the oil country. Governing the system is a Backwash Filter Programmer Control Panel, by Instruments, Inc. . . . and at the heart of the panel, an Industrial Timer Corporation Series SF time delay timer.

Wherever precise timing controls are required for industrial processes or in equipment, Industrial Timer Corporation has the wide range of precision instruments and the wide experience to meet your need. If timing is of the essence . . . take the time to consult an Industrial Timer expert. Phone or write us.

INTERVAL TIMERS



RUNNING TIME METERS

TIME DELAY TIMERS

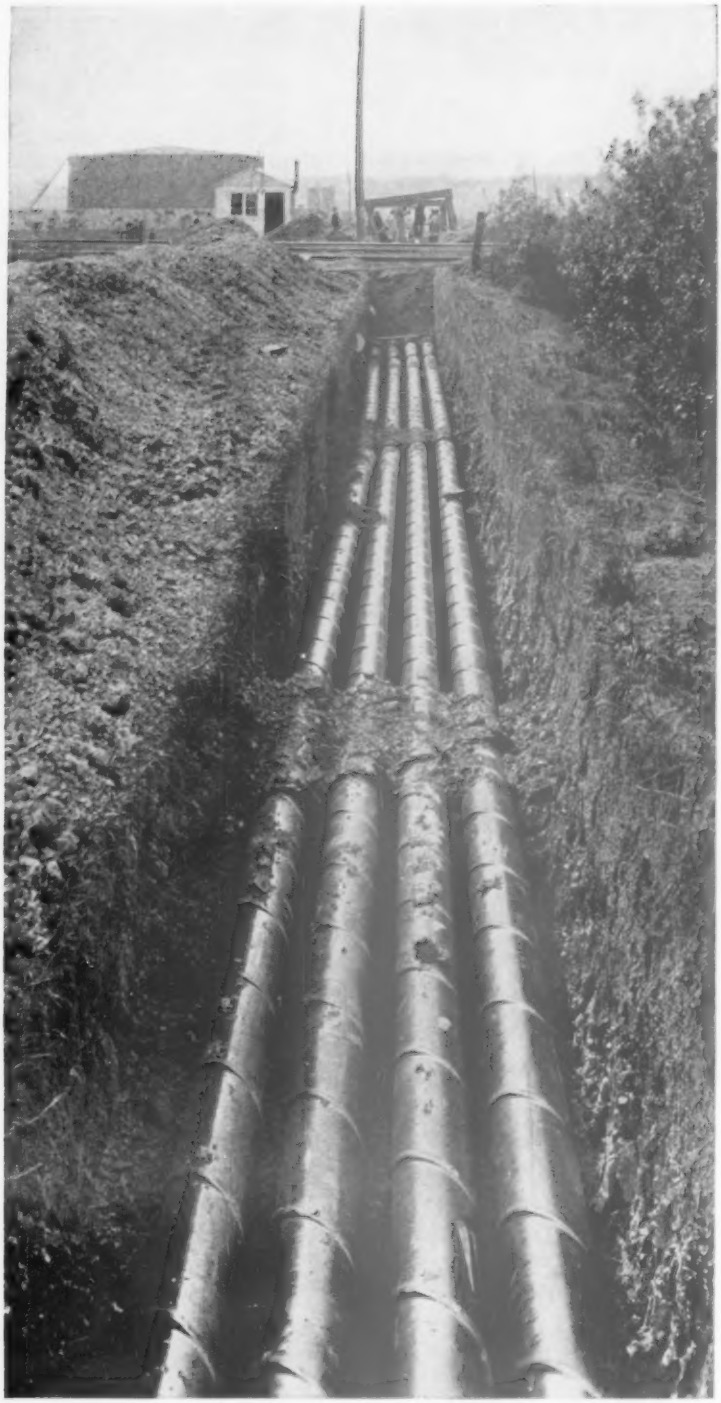
RECYCLING TIMERS

INDUSTRIAL TIMER CORPORATION

INDUSTRIAL TIMER CORPORATION

4th Ave. & McCarter Highway, Newark 4, New Jersey

Manufactured and sold in Canada by
SPERRY GYROSCOPE OTTAWA LIMITED • 3 Hamilton Ave., Ottawa, Canada • PA 8-4681



NAYLOR PIPELINE PERFORMANCE

- ★ Light weight lines without sacrifice of strength.
- ★ Lockseamed and spiralwelded pipe for extra collapse strength and safety.
- ★ Easy handling and installation.
- ★ Furnished in diameters from 4 to 30 inches.
- ★ Available with pipe ends of standard weight thickness.
- ★ *Write for Bulletin No. 59.*

NAYLOR PIPE *Company*

1232 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

EXCLUSIVE DISTRIBUTORS IN MID-CONTINENT AND GULF COAST AREAS: MID-CONTINENT SUPPLY CO. • Fort Worth, Texas and Branches

of operations; and Walter P. Rhodes, general manager of marketing.

J&L Supply Div. consolidates

. . . two sales districts under a new central stocking program, according to W. L. Wolfe, vice president in charge of sales. The southern Oklahoma district, with stores at Duncan and Healdton, will be combined with J&L's North Texas district, including stores at Muenster, Graham, and Wichita Falls.

R. T. Bouldin has been appointed sales manager of the new

R. T. Bouldin

W. R. Layne

district, with headquarters at Wichita Falls. W. R. Layne takes over as resident manager of sales at Ardmore, Okla. He will retain management of the Duncan and Healdton stores and all J&L personnel in what was the southern Oklahoma district.

At the same time it was announced that two Jones & Laughlin salesmen have been transferred: C. K. Ridgeway, from Mexia, Tex. to the division's Dallas office; and W. E. Hamon, Jr., from Dallas to Tyler, Tex.

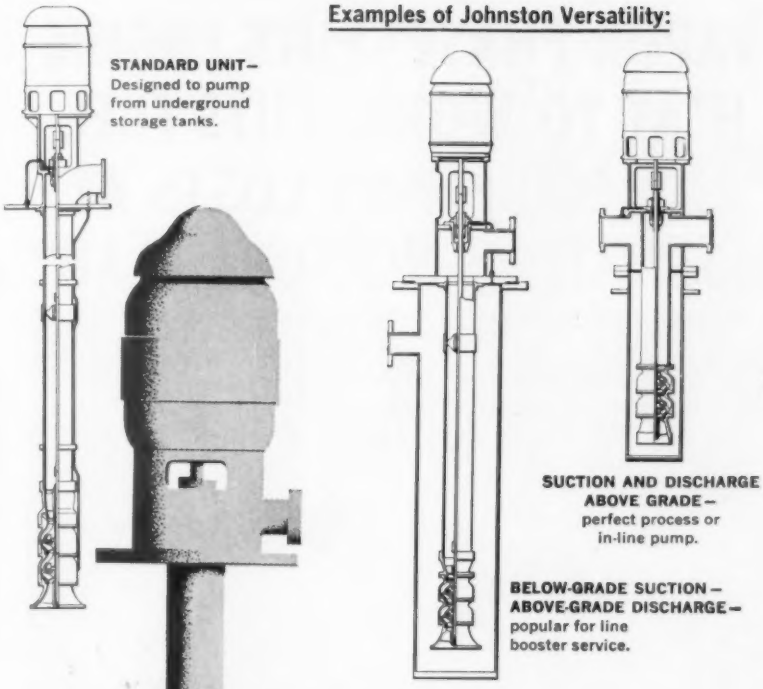
Black, Sivalls & Bryson names

. . . three new product sales managers, announces Paul Bartley, sales vice president. Appointees are: Ralph E. Stevens, product sales manager for oil-production equipment; J. E. Byers, for gas-process equipment; and Edwin C. Young, for mass flowmeters and Uniflux heating equipment.

Universal Oil Products promotes

. . . four chemists and engineers in an expansion of UOP's chemical-products-department activities, reports Marcus R. Schrein, senior vice president. Promoted were: Leonard J. Daniels, Jr., head of catalyst sales; Alfred E. Hoffman, assistant manager of chemical-product sales; William K. Hunter, manager of chemical-product development; and

Examples of Johnston Versatility:



STANDARD UNIT— Designed to pump from underground storage tanks.

SUCTION AND DISCHARGE ABOVE GRADE— perfect process or in-line pump.

BELOW-GRADE SUCTION— ABOVE-GRADE DISCHARGE— popular for line booster service.

VERSATILE VERTICALS BY JOHNSTON FOR VOLATILE FLUIDS

GASOLINE - CRUDE OIL - AMMONIA - L-P GASES
PIPE LINES - REFINERIES - AIRPORTS

Can be designed to operate with zero suction head and/or net positive suction head.

COMBINATION TURBINE-PROPELLER STRIPPING PUMP— maximum suction lift without vapor lock.

WET PIT BOOSTER, TRANSFER OR CIRCULATING PUMP— no expensive priming device necessary.

DIRECT DISPENSING— For transfer of volatile liquids and chemicals.

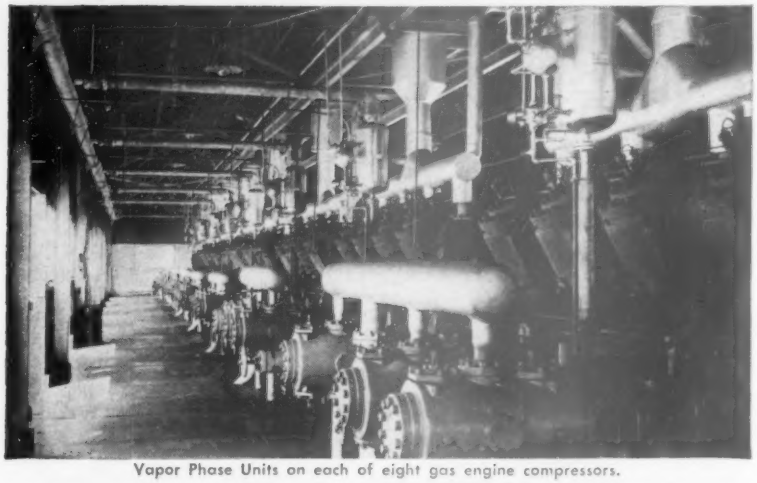
UNLIMITED FLEXIBILITY— Johnstons fit any piping layout— satisfy virtually all pumping requirements.

CHECK THESE OTHER FEATURES: Economy of higher speeds; Non-overloading power characteristics; Steep head-capacity stability.

For complete details and typical applications, write for colorful bulletin.

Versatile Verticals by | JOHNSTON PUMP COMPANY
3272 E. Foothill Blvd., Pasadena, California

VAPOR PHASE® PUTS ENGINE HEAT TO WORK, CUTS FUEL AND EQUIPMENT COSTS AT TIDEWATER'S VENTURA PLANT



Vapor Phase Units on each of eight gas engine compressors.

BEFORE VAPOR PHASE®

Power at the VLW Lease Gas Compressor Station consisted of eight Gas Engine Compressors of 2250 BHP total.

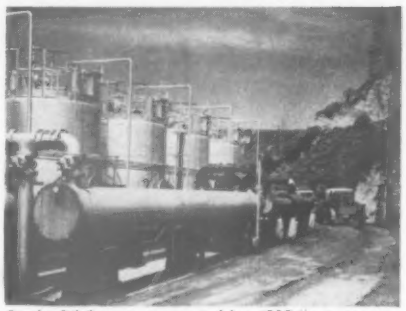
Engines were cooled by large radiators with fans, driven by separate multiple cylinder gas engines.

Gas-Fired Oil Heaters were used to separate water and sludge from crude oil.

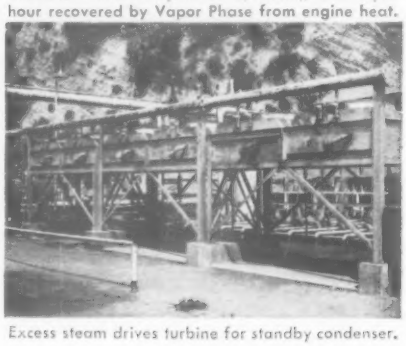
Therefore Tidwater had the cost of additional engines and fuel to cool compressors, plus fuel cost to heat oil.

AFTER VAPOR PHASE® INSTALLATION

1. Engines are cooled by thermal circulation providing uniform temperature throughout the engine.
2. Separate gas engines to run radiator fans are eliminated.
3. Recovered heat from the engines produced 6750 pounds steam per hour which is fully utilized.
4. Gas-Fired boiler is eliminated.
5. 4,000 pounds of steam per hour heats the crude oil to separate water and sludge from oil.
6. Excess steam is used to heat the workmen's locker room and to drive a steam turbine for the standby condenser-engine cooler.
7. Engine maintenance is reduced.



Crude Oil Treaters operated by 4000# steam per hour recovered by Vapor Phase from engine heat.



Excess steam drives turbine for standby condenser.

E C VAPOR PHASE

ENGINEERING CONTROLS, Inc.

AN AFFILIATE OF ST. LOUIS SHIPBUILDING & STEEL CO.

611 E. Marceau, St. Louis 11, Mo.

Robert P. Zimmerman, research coordinator, chemical-products research.

Edward J. Murphy is elected

E. J. Murphy

...secretary of Stone & Webster Service Corp., New York City management-advisory firm, replacing Carl H. Conley who retired after 38 years with the company. The appointment was announced by president L. S. Storrs, Jr. Murphy, assistant secretary since 1954, joined the company at Boston in 1921.

PESA elects officers, directors

...at the organization's annual meeting held recently in White Sulphur Springs, W. Va., W. H. Larkin was elected president of the Petroleum Equipment Suppliers Association, and W. J. McWilliams became vice president. Larkin is president and general manager of Larkin Packer Division of Koehring Co., Waxachie, Tex. McWilliams is president of Republic Supply Co., Oklahoma City.

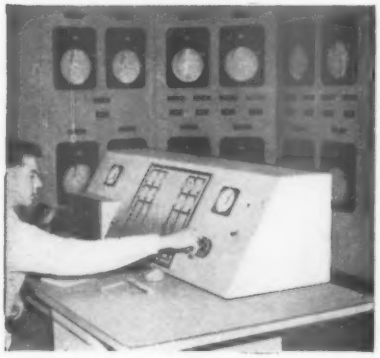
Selected to serve as directors-at-large were Frederick F. Murray, Oil Well Supply Division; Ted Sutter, Baker Oil Tools; F. M. Mayer, Continental-Emsco; M. B. Jones, S. M. Jones Co.; D. D. Bovaird, Bovaird Supply; M. E. Montrose, Hughes Tool; Rainey Elliott, Jones & Laughlin Supply Division; Grover Kilgore, Halliburton; Wallace D. Wilson, Wilson Supply; and Elliott A. Johnson, Schlumberger.

E. S. Dulin, Byron Jackson Tools, and J. A. Crawford, Youngstown Steel Products, were elected directors emeritus.

Regional directors elected to serve during 1961 include the following from the eastern district: Karl Elliott, W. H. Greer, Lloyd Lanphere, J. T. Murray, F. E. Rath, Craig Rowley, Paul H. Scherf, John G. Seiler, Sidney A. Shuman, and H. Bernard Wehrle.

New directors in the Northern Mid-Continent district are: F. E. Bernsen, W. L. Butler, G. W. Carrington, Jene Harper, K. W. Lineberry, E. E. Rubac, W. J. McWil-

AUTOMATION ECONOMY



FOR YOUR SYSTEM

American® telemetering and telecounting equipment helps one man do the work of many ...in gathering fields, transmission and distribution systems.

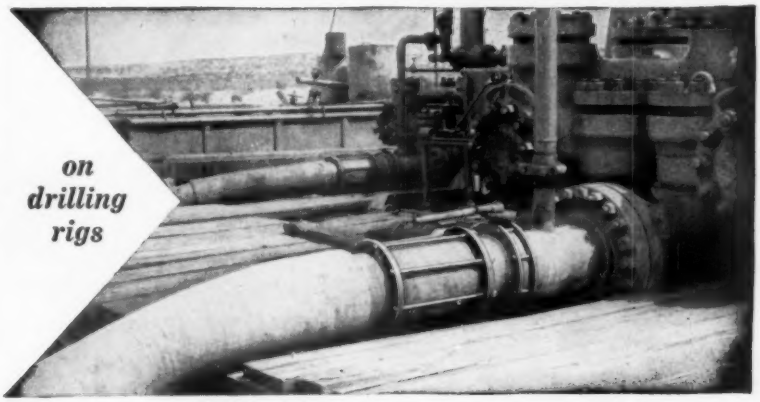
One man at a central dispatching station instantly receives accurate flow and pressure readings from remote points and adjusts for demand with remote-set controllers.

For further information consult your American representative.

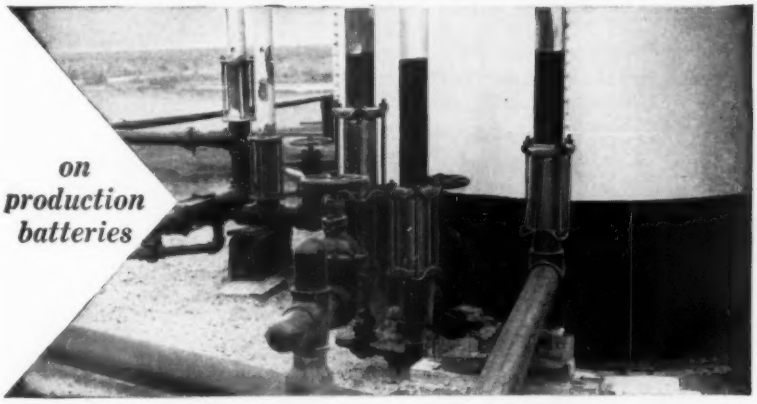
American Telecounters accurately transmit Base Volume Index indications of gas quantities computed to base temperature and base pressure conditions, to central locations.

AMERICAN®
METER COMPANY
INCORPORATED ESTABLISHED 1903
General Offices: Philadelphia 16, Pa.
Sales Offices in Principal Cities

Dresser® Couplings—



fast, vibration proof...



safe, permanent joints!

Dresser Couplings are easily installed . . . only two man-minutes per bolt with a simple hand wrench. The specially compounded Dresser Gasket provides the essential "give and take" to absorb vibration, settlement, and other stresses that might cause damage. It also allows up to 4° pipe deflection at every joint and still maintains a permanent, bottle-tight seal. Eases of take-down and re-usability of Dresser Couplings are a tremendous asset where you may need to add new pumps, valves or lines. Send for Dresser Catalog No. 531. It contains more detailed information and complete specifications on *all* Dresser Couplings, Fittings and Pipe Repair Products.

• GET THEM FROM YOUR LOCAL OIL FIELD SUPPLY STORE

Bradford
Pennsylvania

Chicago
Houston
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DRESSER
MANUFACTURING DIVISION

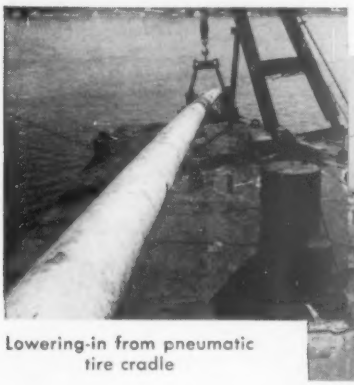
ONE OF THE DRESSER INDUSTRIES

The three barges at work in mid-river

spi COATED AND WRAPPED PIPE CHOSEN FOR RIVER CROSSING

The Mississippi River Transmission Corp. recently laid two 12¾" O.D. pipelines across the Mississippi River just above the Chain of Rocks Bridge at St. Louis. Standard Pipeprotection's coated and wrapped pipe was selected for this important job.

Count on SPI c/w pipe for long lasting pipe protection.



Lowering-in from pneumatic tire cradle

Welding pipe lengths together on the barge

Placing front length of pipe in position on pneumatic tire cradles

SPI®

standard pipeprotection inc.

3000 SOUTH BRENTWOOD BLVD. • ST. LOUIS 17, MISSOURI

liams, L. B. Meaders, A. C. Polk, and C. R. Zimmerman. In the Southern Mid-Continent district: R. A. Baker, K. W. Davis, Sr., Ott Hammer, M. F. Hazel, S. J. Iverson, W. H. Larkin, R. H. McLemore, Taylor Milton, L. L. Rector, and T. N. Shults.

Gulf Coast district directors are: George B. Coale, G. B. Coleman, W. R. Davis, J. T. Kenneally, L. A. Little, Donald W. Mackie, Jr., B. R. McNulty, J. J. Neale, W. E. Scarborough, and Richard E. White. Pacific district: Richard M. Chewning, H. J. Hagn, Harold E. Howard, Arthur S. Marshall, I. J. McCullough, John B. Merritt, H. H. Peters, Andrew W. Rose, Elmer J. Weis, and Elvin K. Wilson.

World's largest junk basket ... designed and manufactured by Bowen Itco, Inc., Houston manufacturer of oil-well fishing and retrieving tools, is checked prior to shipment to the oil fields of Iran. On each side are 15-in. junk baskets, normally the largest produced by the firm.

The giant reverse-circulation-type junk basket, measuring 22-in. o.d., retrieves a 17-in. core with a 23-in. o.d. mill shoe. It's used in a 26-in. hole.

The instrument is lowered into a hole to retrieve all types of small objects which gather at the bottom as a result of bit failures and milling jobs, or are accidentally dropped down the hole. The junk basket is designed to direct these objects into its long, hollow barrel and retain them as the basket is raised to the surface.

2-pen Foxboro Dynalog Recorders chart both upstream interface profile and station profile on Phillips' two pipelines. Upstream record allows operator to select best cut point well in advance of interface's arrival.

Automatic Foxboro interface detection system eliminates guesswork at Phillips pipeline terminal

operators get interface profiles in advance...know exactly when to switch tanks

There's nothing haphazard about interface detection at the Phillips Pipe Line Company Terminal in East Chicago, Indiana. A Foxboro Interface Detection System sees to that.

This unique Foxboro system is based on the fact that even slight differences in grades or brands of petroleum products have measurably different dielectric constants. Sensitive Capacity Dynalog* Recorders measure this difference, both at the pipeline delivery station, and at a point 3 miles upstream. Foxboro Teletax* Telemetering brings the two measurements together on a single chart at the delivery point.

From the shape of the upstream record, the operator selects the best cut point and sets his index. When station interface record matches index, switch-over is made.

Phillips dispatchers find their Foxboro system eliminates sampling and guesswork — cuts product contamination to a new minimum. It can do the same for you. Ask your Foxboro Field Engineer for full details, or write for Bulletin 20-11. The Foxboro Company, 606 Neponset Ave., Foxboro, Mass.

Reg. U.S. Pat. Off.

FOXBORO

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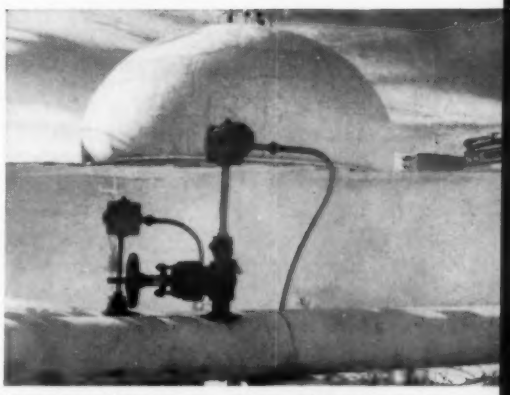
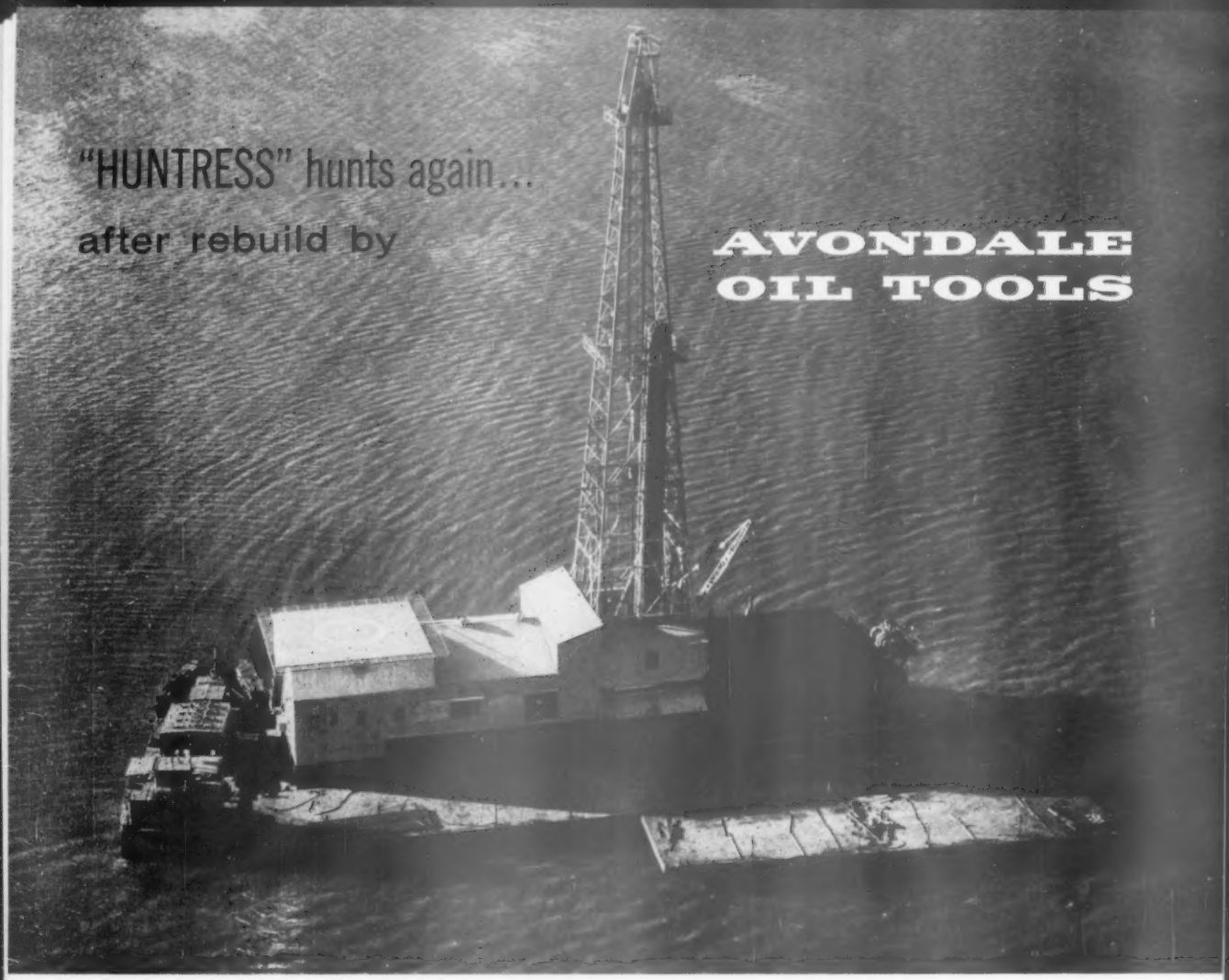


Capacity probes at upstream measuring point, and at terminal (shown above) measure dielectric constant of product passing through pipeline. Upstream measuring station is unattended — profile is telemetered to Dynalog Recorder at terminal.



"Huntress" is her sleek, efficient self again, at work on location for Dixie Drilling Company, after her overhaul at Avondale Harvey.

The 180' inland drilling barge suffered severe fire damage—requiring repair or replacement of structurals and equipment, installation of new rotary. While she was in, her quarters and change room were modified and a new helicopter deck was installed.

The work was done efficiently and fast by the Oil Tools Department of Avondale Harvey —specialists in rig repair and overhaul.

Avondale Harvey combines drydocks, marine machine shops, oil tools shops and specialized technical know-how into a complete, "one-stop" drilling equipment service. Avondale Harvey is at your service day and night.

AVONDALE SHIPYARDS, INC.
HARVEY QUICK REPAIR DIVISION
P. O. BOX 116, HARVEY, LOUISIANA • PHONE Fillmore 1-4211

Drive compound for draw-works

Tool pusher's office with drilling control indicators

Crew's lounge

Helicopter flight deck

Large mobile rig is Libya bound

A COMPLETELY MOBILE RIG, the Desert Star No. 3 which was designed for operations in the North African desert of Libya, has been delivered to Camdrill International, Inc.

The rig consists of four large off-road trailer units which carry all the drilling equipment. One of these trailers is the largest drilling-rig trailer ever developed. This unit carries two Ideco MM 600 mud pumps and two 400-hp. Caterpillar diesel engines. The trailer weighs 186,000 lb. and is mounted on eight 21:00 by 25-in. desert tires.

The draw-works trailer includes an Ideco H-525 hoist which is also powered by two Cat 400-hp. diesel engines. A propeller shaft between the draw-works trailer and pump trailer allows for complete flexibility in power distribution. The rig, built by Ideco, Inc., is designed to drill to 9,000 ft. with 4½-in. drill pipe.

A special feature of the rig is that all six of its Cat diesel engines have been engineered to burn a wide variety of crude oil. Special filters and a stainless-steel fuel system allow use of most field crude oils, resulting in important savings.

This is the third Desert Star rig put into operation by Camdrill. Two previous Desert Star rigs are operating successfully in Libya and are demonstrating that a substantial saving in moving and rigup costs can be realized with mobile equipment.

Arrival of the rig in North Africa is scheduled in the near future. It will then be moved into the Libyan desert where it will drill for Esso Sirte of Libya.

Texas firm gets Australia interest

A TEXAS FIRM, North Star Oil Co., Victoria, announced that it purchased, for stock and cash, Triton of Australia, Ltd., which holds the right to prospect 82,000 sq. miles (52,480,000 acres) in Queensland, Australia.

The acquisition, President William Moss stated, is in line with terms of its proposed consolidation with Westwater Corp. of Midland, Tex., which both boards have approved and on which shareholders of each company will vote in the near future.

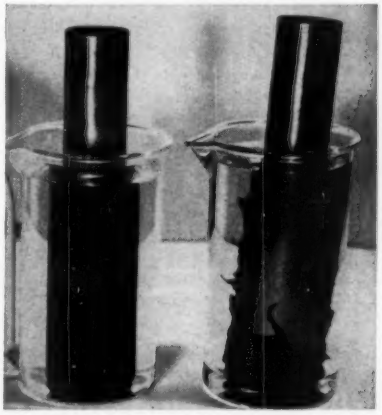
Most of the huge concession is on land but some portions extend from 15 to 40 miles offshore into that part of the South Pacific lying within the Great Barrier reef. Known surface structures in portions of six sedimentary basins, including the Bowen, Great Artesian, and Carpentaria, lie within the area, Moss pointed out, adding that upon shareholder approval of the North Star-Westwater consolidation agreement the combined company will embark upon an active geological program.

Moss observed that no test wells for oil or gas have ever been drilled on the Triton concession. He noted, however, that Union Oil is currently drilling a well in Queensland (1 Cabawin wildcat) which has had some promising shows and that several other major companies, including Plymouth Oil, Sunray Mid-Continent, Delhi-Taylor, and Standard of New Jersey currently hold prospecting rights there.

"We feel that in this Queensland concession," Moss emphasized, "there is a real potential for developing huge reserves for our company.

"The market for oil in Australia is excellent and rapidly growing. The country currently is importing 225,000 bbl. daily and, to spur domestic exploration, still in an early phase, it is offering financial assistance in approved drilling prospects, sometimes underwriting half the drilling costs. A minimum of 25 exploratory wells, it is estimated, will be drilled in Australia within the next 12-month period."

here's how Depban works to stop paraffin troubles before they start



This photograph shows how Depban* paraffin inhibitor works.

Both steel cylinders were given a coating of paraffin similar to that which occurs under actual well conditions.

There was one difference, however. The cylinder on the right had been treated previously with Depban.

This photograph was taken just 25 seconds after both cylinders were immersed in tap water at room temperature. Notice that paraffin on the cylinder treated with Depban is falling off rapidly while paraffin on the untreated cylinder is unaffected.

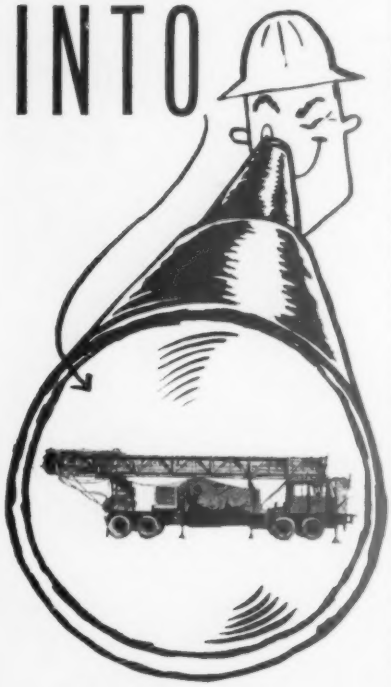
For full details on this revolutionary new way to control paraffin problems, call your Dowell representative. *DOWELL TRADEMARK

PRODUCTS FOR THE OIL INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

WORTH LOOKING INTO



Get the facts about—

WINCHMOBILE

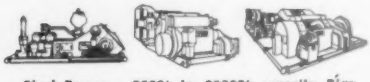
Before you buy get the facts on light weight...low cost...long life Wilson Winchmobile with the cross mounted engine which saves moving parts and increases hp to the drum by 20%!

Wilson

WILSON MFG. CO., INC.

Wichita Falls, Texas • The Home of RED IRON

Winchmobiles Traveling Blocks Speedwinches



Slush Pumps 3000' to 25000' capacity Rigs

Additive cuts oil friction in pipe

AN OIL ADDITIVE that reduces pressure loss due to friction in pipe is now available to the industry.

Primary application of the agent, known as J105, is in fracture treatment of oil and gas wells.

Manufactured by Dowell Division of Dow Chemical Co., the agent is blended with crude oil at the surface, and reduces the friction loss as the fracturing fluid is pumped down the tubing. In effect, this puts the horsepower where we want it—at the sand face, and not lost in the pipe.

According to R. E. Hurst, manager of Dowell's technical service, the agent will reduce friction loss from 30 to 70%. In a recent field test in a 6,000-ft. well, 32° API crude was pumped through 2½ in. tubing at 10 bbl. per minute. Without J105 the friction pressure was 3,600 psi. With the addition of J105 at the same pump rate, the friction pressure was reduced to 2,160 psi. At this rate and pressure, the savings amounted to 350 hp.

In terms of fracturing expense, this saving in horsepower can mean that one less pumping truck would be required for the same job. Cost of the material is one cent per gallon of treated crude, in the Mid-Continent area. Price is slightly higher in California and Canada.

The product reduces friction by reducing turbulence in the flow stream. In engineering language, the treated fluid shows some non-Newtonian properties, and the friction factor is less for the same Reynolds number, Hurst said.

The product was 9 months in the development state, and has been field-tested for about 2 months.

Firm branches out

A Midland, Tex., firm, Whipstock Inc., has opened an office in Oklahoma City. W. C. (Pat) Patterson is in charge of the regional office whose address is 5810 Wheatland Road. Whipstock is a company specializing in directional drilling and will operate in Oklahoma, Kansas, Arkansas, Indiana, Illinois, West Virginia, Pennsylvania, and Michigan from the Oklahoma City office.

MARTIN RUBBER & DUCK RINGS give excellent life in dirty abrasive fluids . . . high or low gravity . . . much or little water . . . shallow or deep wells. They last for years in the easier pumping wells. Replacement rings cost comparatively little.

MARTIN PLUNGER BODIES, precision grooved, drilled and threaded (no underneath fluid passage), usually last for years. Tube or barrel costs are often cut in half.

The replaceable SYNTHETIC RUBBER GUIDES in MARTIN CAGES last longer than any metal, and the cushioning of the ball increases your ball & seat life. Results are often truly amazing. (Patent No. 2,591,174)

Write for our new catalog or see it in the Composite (24th Edition). All products sold thru supply companies.

JOHN N. MARTIN

Manufacturer

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Here's how they **keep mud moving** *on "Mister Cap"*

Mounted directly above the mud tank—with its steel shaft reaching down into the mud—is a LIGHTNIN Mixer.

At the bottom of the turning shaft, a big turbine-type impeller drives the mud in a steady, powerful flow. All through the tank, mud keeps mixing, interchanging, equalizing. It doesn't settle out. It's always in condition. And if necessary, mud weight and viscosity can be changed at the drop of a hat.

This is what you'll see aboard "Mister Cap," the 4000-ton all-electric offshore mobile drilling barge that brought in its first producer in just eight days—and has been meeting its owners' expectations ever since as a model of drilling efficiency.

You can get faster, safer, more productive drilling with LIGHTNIN Mixers on *your* rigs. Fewer stops. No long waiting for mud to get into condition. Surer protection against blowouts.

Cut pump maintenance cost, too. When you have LIGHTNIN Mixers you don't have to use your standby pump for jetting mud. It's always instantly available for use on the hole.

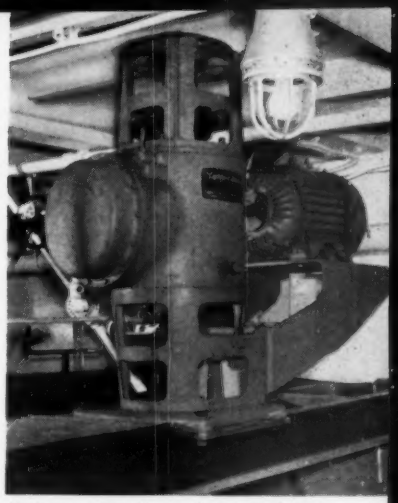
See for yourself why so many offshore and land rigs use this simple, fast way to control mud. Ask your LIGHTNIN Mixer representative to set up a visit to one of these rigs in your area. Call him today (he's listed in Composite Catalog). Or write us direct.

"Lightnin® Mixers"

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 174-e Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.



Mud mixers like this one keep all of the mud in suspension, with uniform gravity and viscosity.

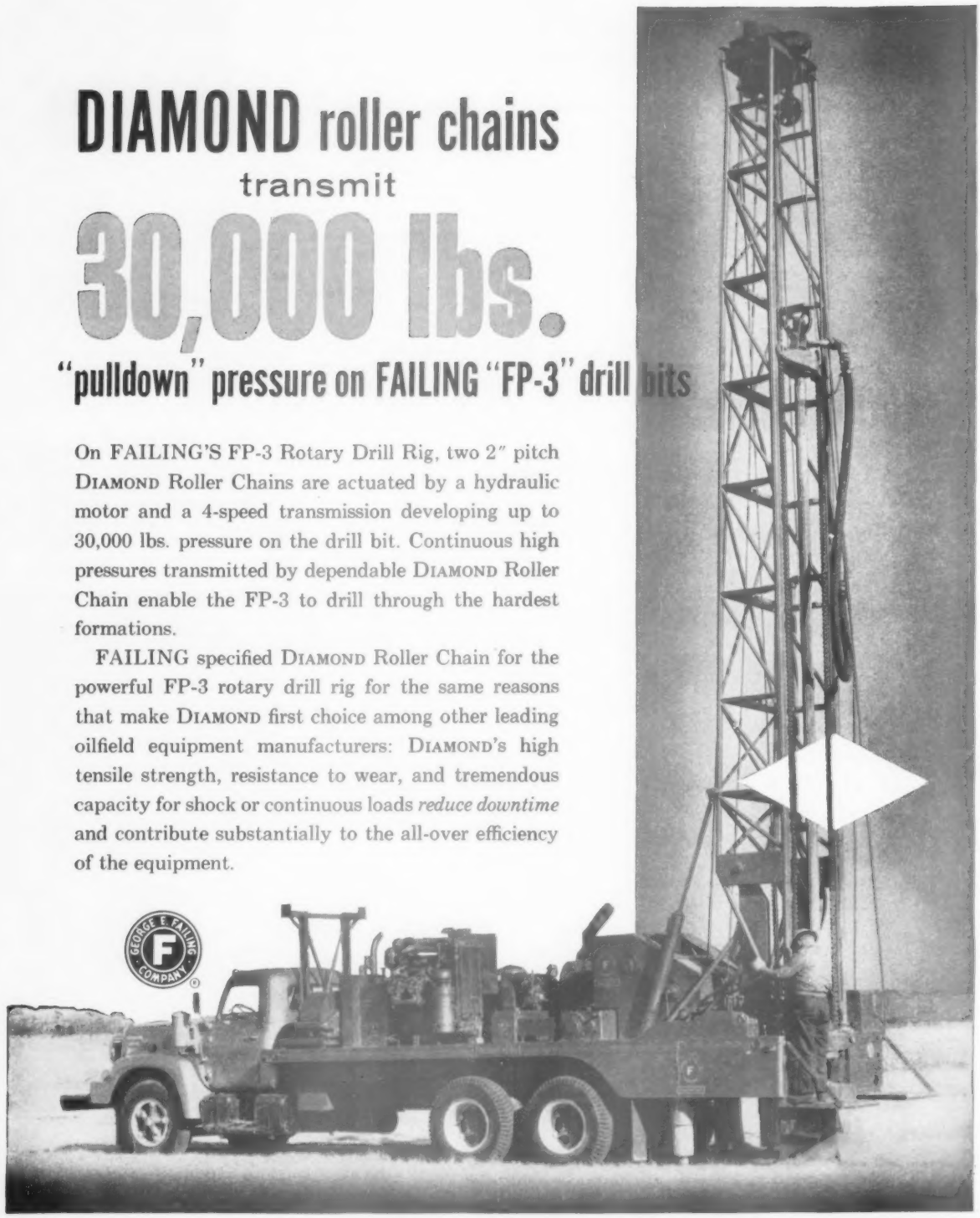
THREE-LEGGED JOB-HOPPER "Mister Cap" spudded and drilled its first producing well in 8 days; has worked steadily in the Gulf since November 1957. Built by R. G. LeTourneau Inc., the barge is owned and operated by Barnwell Offshore, Inc.

DIAMOND roller chains transmit 30,000 lbs.

"pulldown" pressure on FAILING "FP-3" drill bits

On FAILING'S FP-3 Rotary Drill Rig, two 2" pitch DIAMOND Roller Chains are actuated by a hydraulic motor and a 4-speed transmission developing up to 30,000 lbs. pressure on the drill bit. Continuous high pressures transmitted by dependable DIAMOND Roller Chain enable the FP-3 to drill through the hardest formations.

FAILING specified DIAMOND Roller Chain for the powerful FP-3 rotary drill rig for the same reasons that make DIAMOND first choice among other leading oilfield equipment manufacturers: DIAMOND's high tensile strength, resistance to wear, and tremendous capacity for shock or continuous loads *reduce downtime* and contribute substantially to the all-over efficiency of the equipment.



Complete stocks of DIAMOND Roller Chains are available from your oilfield store . . . or consult the Yellow Pages of your phone book for the name of your nearest DIAMOND Distributor.

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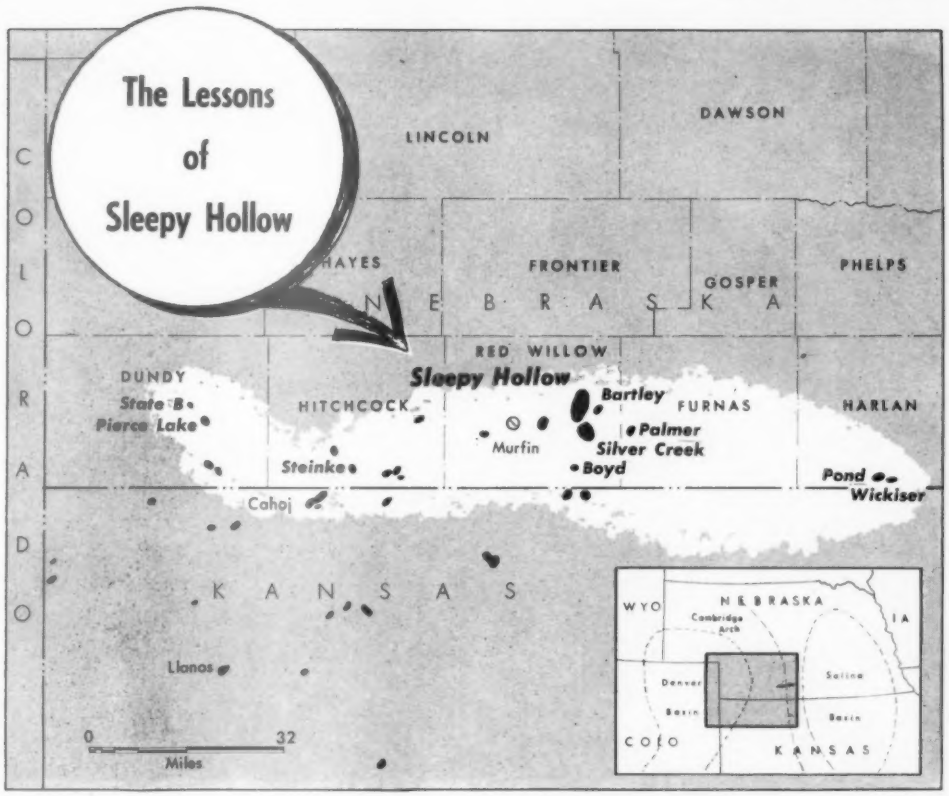


RECENT discoveries in Southwest Nebraska emphasize the growing importance of Pennsylvanian and Cambrian reservoirs to that state's reserves. Star of the moment is Sleepy Hollow field, busiest area in the entire Rocky Mountain region.

Sleepy Hollow isn't

BY FRANK J. GARDNER

BUSIEST AREA in the Rocky Mountains—that's Sleepy Hollow, Southwest Nebraska's newest jackpot. Today, scout reports list 57 active wells in the field; this includes wells drilling, completing, and announced.

This Red Willow County field, when first chronicled here last June, was hailed as the first Cambrian discovery in Nebraska. Immediately, stratigraphic feathers flew. Many geologists in the Rockies condemned the Cambrian tag as a mistake in interpretation—basal Pennsylvanian was the proper age of the pay. The discoverer and many other operators stuck to their guns; it was definitely Cambrian. The controversy still goes on, and in an article soon to be published in these pages, we hope to lay the subject to rest for good, based on conclusions from impartial studies by the Kansas and Nebraska State Geological surveys. Until then, the Cambrian label sticks.

Cambrian or no, it's the best field found in Nebraska in several years. And its development over the past few months holds a lesson for oil hunters: there's many a similar field to be found along the flanks of the Cambridge arch — multiple-pay fields at reasonable drilling depths.

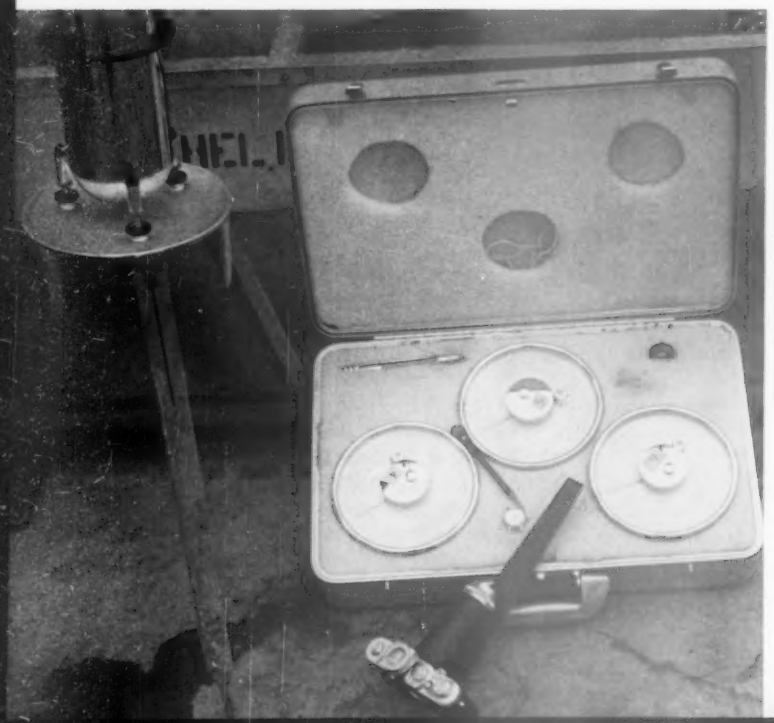
Sleepy Hollow is the climax to a campaign that began with the discovery of Llanos field in Sherman County, Kansas, in 1958. Following that strike, the Kaneb country became a beehive of leasing and drilling activity. Several new Pennsylvanian fields were found, but only two (Cahoj and Reiher) were of real importance. Then, interest leaped over into Nebraska's Red Willow County, and things really began to hum. Ackman field was found in 1959; it was a Pennsylvanian field and was the star performer in Nebraska development drilling during 1960. Now, the rapid growth of Sleepy Hollow has shoved Ackman aside, as operators aim at both Pennsylvanian and Cambrian reservoirs at depths of 3,200-3,500 ft. Completions have been made in Lansing-Kansas City, Cherokee, Marmaton, and Reagan (Cambrian) sands.

It's largely an independent play, with Ohio Oil Co. and Skelly Oil Co. the only majors holding any cards. Leading developers have been Pubco Petroleum Corp. and Midwest Oil Co. Murfin Drilling Co. opened the field with its 1 Barth, completed early in July 1960; Murfin has done much of the development drilling for Pubco and others.

Two years ago, this column declared: "Nebraska stands to gain more from this Kaneb theater play than Kansas, if it can throw off its Denver basin obsession." Obviously, Nebraskans took the hint, and many another multiple jackpot may result from the lessons learned at Sleepy Hollow.

STATION READING is taken with gravity meter while pilot makes notes on map. Using a combination of aerial and USGS topographic maps to locate general area, exact fixes are then obtained by use of the topographic camera after gravity meter is read. This two-man helicopter survey team is ideally suited for fast, accurate, low-cost reconnaissance.

Teamwork speeds Alaska oil hunt



BY PETER B. BIKE
Geophysical Editor

HERE'S THE STORY of a coordinated Alaska exploration program. It involves three contracting exploration firms who pooled their manpower, equipment, and know-how to work some little-known and rugged areas of our far-north state.

A couple of years ago a new combine was formed. Its name is PRECON with home office in Tulsa and is made up of Precision Explora-

GRAVITY instruments used in this operation include a bank of three altimeters, a recording baragraph, a small gravity meter, and photographic equipment. For precise gravimetric mapping, a small special-design surveying instrument is used.

HELICOPTER AIRLIFT provides optimum accessibility of gravity survey. Two-man crew consists of pilot and instrument man. The Bell J-5 easily handles the light load of instruments and men and can be equipped with either skids or floats.

ALMOST ALL SUPPLIERS are the result of custom planning and transportation for Alaskan exploration crews. For the work done in the Susitna River Valley, this LSM was used to barge equipment from Anchorage to the mouth of the Susitna River. The crew is storing 55-gal. fuel drums after unloading.

AIRBORNE SEISMIC DRILL is a self-sufficient, compact unit. Air-lifted by helicopter to the shot points, drill can go to depths of 70 ft. Usual depth of shot is 50-60 ft. on single holes. Often multiple holes are required for pattern shooting and these are shallower. Note the short lengths of drill pipe used.

AN INNOVATION for comfortable housing was the result of prior work done at NPR-4 in northern Alaska by the Navy and the USGS. The Jamesway hut is assembled first by laying the wooden floor. After wooden ribs are erected, a canvas cover is thrown over the top and fitted. Next follows a layer of glass wool and another canvas over it. With preassembled ends and three-layer roofs, these huts make a comfortable abode. Size of the hut is 16 by 29 ft. When the base camp is abandoned permanently, it is usually less expensive to walk off and leave the huts.

FRESH SNOWS make the Sno-Traveler a mighty handy piece of equipment. Contrary to common belief, Alaska has some beautiful weather and is not one big, frozen iceburg. The Sno-Traveler is used in seismic work to lay spreads and phones and for general mobility. Equipment shown is ski trailer which carries supplies. In background is a recording doghouse.

SNO-TRAVELER is gasoline-powered vehicle with a half-track drive in the rear and skis on front. It is best adapted to work when the snow has sufficient depth to support its weight without bare ground drag.

Is "any old" wire rope out of "any old" stock good enough?

Not when you can get what you need from the best combination of wearing qualities in the right Macwhyte!

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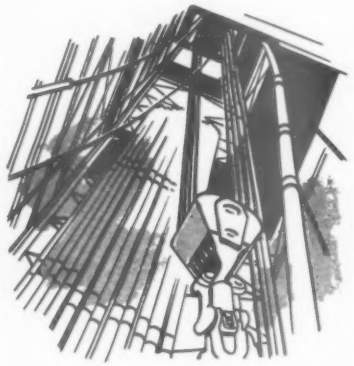
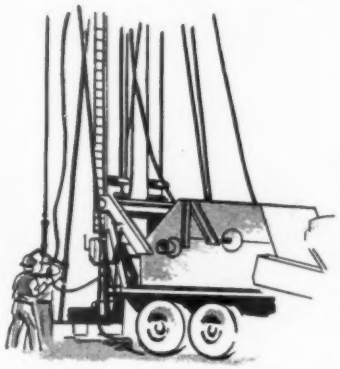
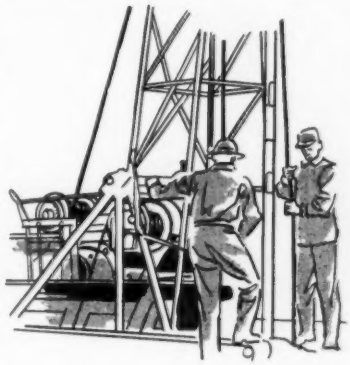


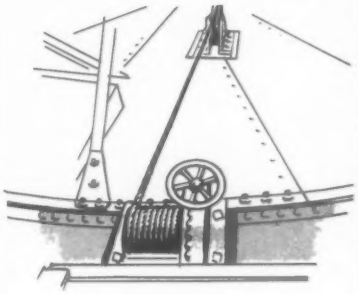
NEED RESISTANCE TO ABRASION?



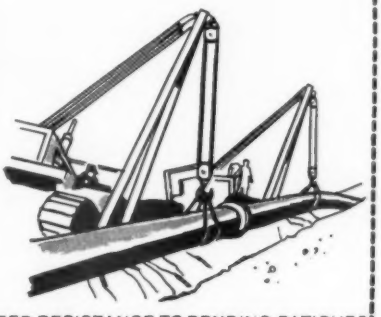
NEED EXTRA REACH AND IMPACT?



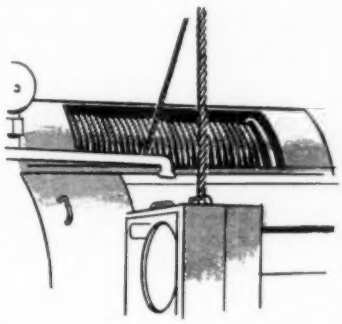
WHICH COMBINATION OF THESE WEARING QUALITIES DO YOU NEED?



NEED RESISTANCE TO CORROSION?



NEED RESISTANCE TO BENDING FATIGUE?



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MODIFICATION of a marsh buggy is the David buggy. It carries the heavier loads in the snow and can be used in soft wet terrain. The recording doghouse is carried to the shot points on the buggy trailer as are the drill, explosives, and heavier equipment on other David buggies. Upon reaching the shot point, the Sno-Travelers are used to lay the cables and geophones.

INTERIOR of the doghouse is crammed full of seismic recording instruments. Present-day small instruments have greatly reduced the over-all weight compared to earlier and larger units. The doghouse can readily be airlifted by helicopter.

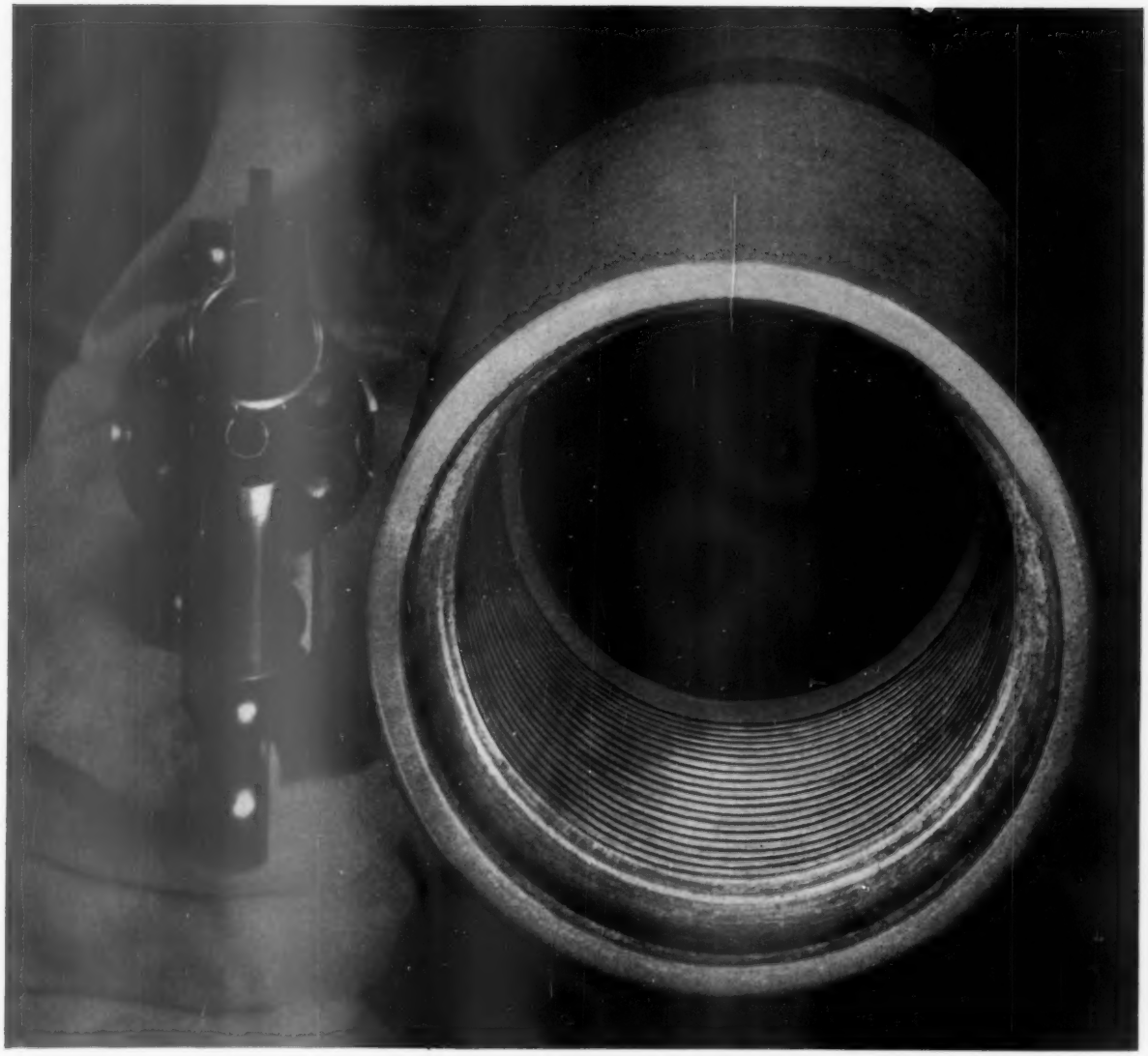
tion Co., Tulsa, Exploration Consultants, Inc., Calgary, and Consolidated Geophysical Surveys, Tulsa. Objective of PRECON is to provide complete and integrated gravity and seismic services to the industry in Alaska on a contract basis.

The organization has been busy since its formation working in the Susitna ("Soo'-sit-na") River Valley, the north shores of the Cook Inlet in the Tyonek area, the Kenai Peninsula, across the reaches of Bristol Bay in the Port Heiden area of the Alaska Peninsula and on the Nushagak Peninsula to the north.

General manager of PRECON in Alaska is Joseph A. Riendl who formerly worked for the USGS and on the Naval Petroleum Reserve No. 4. He is a University of Alaska graduate and has had wide field experience. His former work in the state has paid off in the selection and management of operating equipment best adapted for local conditions.

Alaskan manager of gravity and magnetic operations for PRECON is H. A. Van Buskirk, who is a graduate of the University of Wisconsin. He has had over 20 years

A LARGE HELICOPTER such as the Sikorsky S-55 can transport an entire seismic crew in several loads. Production is generally good and crew will shoot five holes on a day by airlift. This compares favorably to slightly over six profiles a day for the truck-mounted crew in a similar area, all factors being about equal.



They've both got a "business end"

In a pistol it's the muzzle . . . and in oil country tubular products it's the threaded connections. This is a vital area that helps determine performance "life-or-death." And it's here that CF&I Seamless Casing and Tubing really has what it takes for success.

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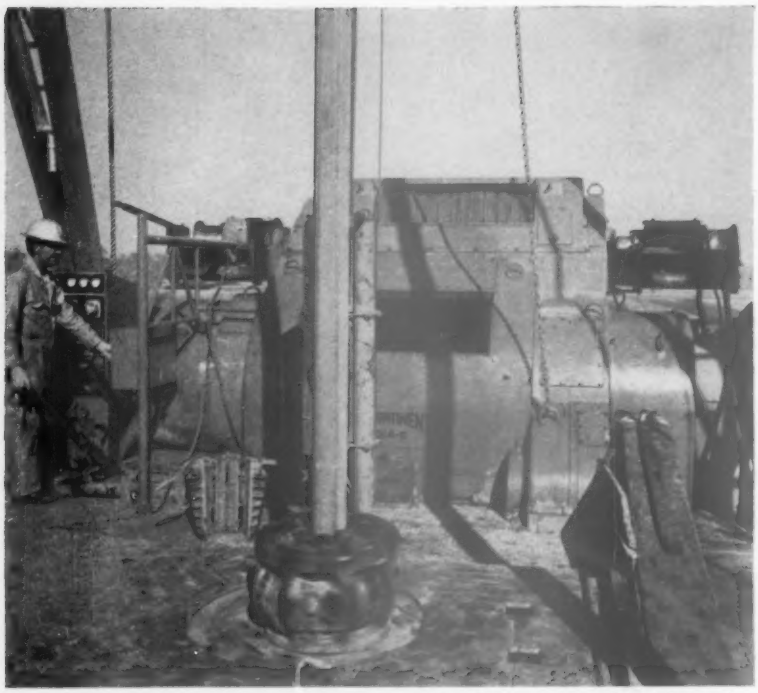
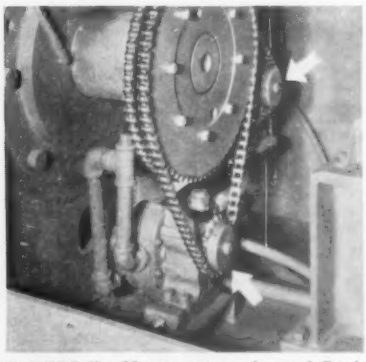


Drawworks manufactured by Mid-Continent Supply Co., Fort Worth, provide rotating and hoisting action to drill oil wells more than 20,000 feet deep.

Brown & Sharpe lubricating pumps help drilling rigs strike oil

There's a carefully-considered reason why designers at Mid-Continent Supply Co. — world's largest independent oil field supply company — use Brown & Sharpe pumps to lubricate their big "drawworks."



Two B&S No. 3S gear pumps (arrows) flood main chain drive (not shown) with oil. Either separately-driven pump will do the job alone.

They must take every precaution against breakdowns in these giants, rated up to 2000 input HP, that turn and hoist miles-long steel drill "strings."

B&S pumps were first tried by Mid-Continent several years ago — proved so dependable they've been used ever since.

In this customer's own words — "Brown & Sharpe pumps do the job we selected them for; have proved entirely satisfactory over a series of years". Quite a compliment, from this type of company, so highly experienced in pumps!

To help *your* machines "strike it rich" — contact Hydraulics Division, Brown & Sharpe Mfg. Co., Providence 1, R. I. — or your nearest B&S engineer-representative.

Brown & Sharpe
PRECISION CENTER

of experience in foreign gravity and magnetic mapping.

The equipment used in the gravity and seismic work is directly related to the season of the year and the terrain involved. When the ground is bare or very little snow exists, either trucks or David buggies are used in seismic work. As the snow deepens, Sno-Travelers and Bombadiers are used.

The gravity work is especially adapted to helicopter lift. Where remoteness of area or surface features dictate, the seismic crews are airlifted from one shot point to another by helicopter. Unlike the gravity work, where a light whirlybird suffices, the seismic crews use larger crafts which are necessary to transport the heavier equipment and larger number of crewmen. Altogether there are three seismic crews, one refraction and two reflection, and 2 gravity parties. The types of helicopters used are a Bell J-5, a Hiller 12-E, and a Sikorsky S-55.

Drilling set for Alaskan area

In Alaska, Clyde Hall Drilling Co. is moving in to drill 1 Duktoth River for Richfield Oil Corp. et al. in Yakataga basin. This new wildcat is located in SEc 24-20s-15eCRM.

Colorado Oil & Gas Co. will begin drilling in May in the Yakutat and Dry Bay area. Objective will be to determine sedimentary characteristics of the area. The strat tests will drill to 4,000-5,000 ft.

Illinois adds good oil producer

A GOOD PRODUCER is reported in Christian County, Illinois. The discovery is Atkins & Hale 1 Ricci-Rink Heirs, N½ SE NE 7-14n-3w.

The well, 4 miles northwest of Edinburg, flowed 720 bbl. of oil per day through ⅛-in. choke after fracture in Silurian at 1,713-49 ft. Location is ½ mile from other production. One location south, A&A Drilling Co. is testing 2 Wheeler Hobbs Unit, S½ SE NE 7. Cores had saturation. Casing is set at this promising test.

Kentucky. In Muhlenberg County, Creek Oil Co. is pumping

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oil at 4 George Geibel Minerals in 5-I-28. Production is from Penn sand at 980-83, Jackson sand at 1,731-43 ft., and Paint Creek sand at 1,870-94 ft. The Penn sand is a new pay for this area, 2 miles northwest of Luzerne. Swab got 48 bbl. of oil in 24 hours. It is also the first triple completion in New Cypress pool.

Richland County, Ill. S. G. Walker completed a ¼-mile stepout at 1 C. P. Porter Estate in SE NE SE 20-4n-10e. It pumped 150 bbl. of oil per day from Rosiclare at 2,979-84 and McClosky at 2,994-3,000 ft. Location is 2 miles northwest of Olney.

Clay County, Ill. Sylvester-Anderson et al. 1 Conley Community, NW SW NE 22-4n-7e, is going on pump after swabbing 30 bbl. per hour. Production is from O'Hara at 2,941-47 ft., a new pay for the area 2 miles west of Sailor Springs.

Midway field discovery finaled in Colorado

Horizon Oil & Gas Co. Completed 1-2 Bauman-A, C SW 2-33s-42w, Baca County, southeastern Colorado, in Midway field. The well flowed 7,500 M.c.f.d. from Topeka perforations at 3,123-36 ft. This well is ½ mile north of 1 Bauman in C NW 11-33s-42w. That well, 1½ miles north of Midway field production, flowed 7,500 M.c.f.d. from Topeka. A hearing on 640-acre spacing for this field will be held in May.

Gas wells expand Kansas' Carver-Robbins field

Carver-Robbins field in western Pratt County, Kansas, has been extended by Braden Drilling Inc., and J. E. Newman et al. Production in the new wells, located in 27s-15w, is from Cherokee Pennsylvanian and Mississippian. Production is in W½ 14, all of 15, 16, 21, 22, 23, 24, 25, 26, 27, 28, 35, and 36-27s-15w.

Braden 1 Tolman, SE NE SW 25-27s-15w, was completed for 1,989 M.c.f.d., from Cherokee sand at 4,453-54 ft. The 1 Barnes in NW SE NW 36-27s-15w, flowed 4,080 M.c.f.d. from Cherokee sand at 4,470-72 ft. The 1 Wilson, NE SW NE 23-27s-15w, flowed 2,180 M.c.f.d. from perforations at 4,425-

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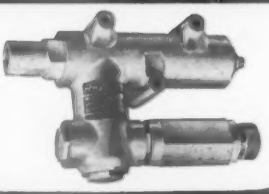
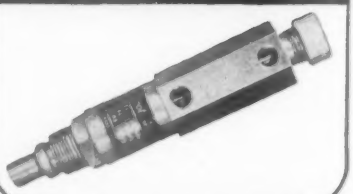


AMOT Model 4021 Temperature Valve has a balanced 3-way action for pilot pressure control in any control system. Actuating temperature settings from 95 to 235° F. Available also with extensions.



AMOT Model B Thermostatic Valve has become Industry's STANDARD for Engine, Compressor, and Process temperature control. It is tamper proof. Available in 1½" to 6" in cast iron, ductile iron or bronze.

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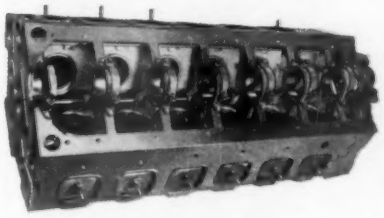

Internally ribbed crankcase gives solid crankshaft support. Extra rear main bearing absorbs side thrust.

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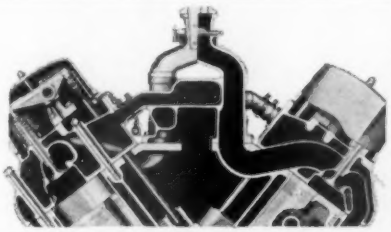
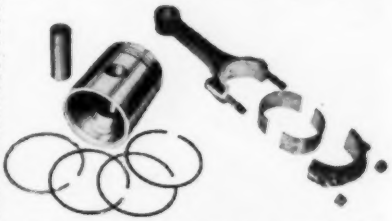


The "Easy Flow" manifold design provides perfect fuel and air distribution to all cylinders through large individual intake ports.



Aluminum pistons are taper cam ground. Full floating piston pins. Connecting rods have big wear-resisting replaceable bearings.

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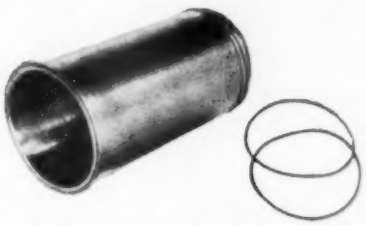
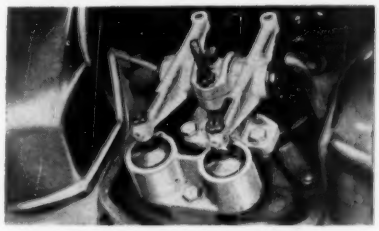
All wearing parts have replaceable bearing surfaces. *All* routine maintenance points are readily accessible.



Long wearing cylinder sleeves are easily replaced and cost far less than reboring cylinder block and installing oversize parts.



Cylinder heads can be removed by one man without disturbing manifold, carburetor, or controls. Note guided valve mechanism.

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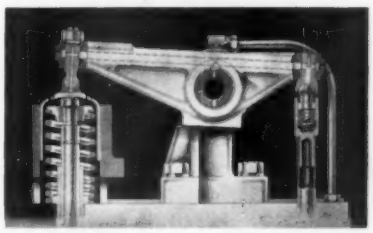
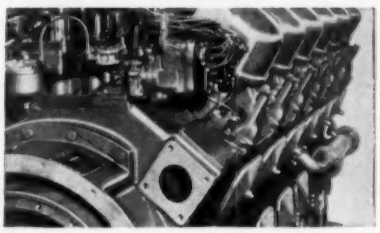


Hydraulic "Zero-Lash" lifters eliminate noise and adjustments and extend valve life. Engines are practically vibration-free.



Exhaust manifold is water cooled and integrally cast into the crankcase to provide cooler operating area and fast warm-up of the engine.

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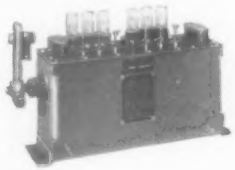

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29 ft. The 1 Jack, SW NE NE 27-27s-15w, flowed 779 M.c.f.d. from Mississippian at 4,515-19 ft. The 1 Welsch, NE SW SW 24-27s-15w, flowed 2,187 M.c.f.d. from Cherokee perforations at 4,448-49 ft.

Workovers. To the south in 28s-15w, Newman et al., have been working over old dry holes and several new wells. The 1 Deal, NW SE NE 22-27s-15w, found oil in the Mississippian at 4,530 ft. The 1 Covey, 11-27s-15w, flowed 1,500 M.c.f.d. at 4,495-99 ft. The 1 Lemon, NW SE SE 16-27s-15w, 1 Robbins, NE NW SW 21-27s-15w, and 1 Verning Estate, SW NE SW 23-27s-15w, are other wells in this area. The 1 Rezeau, ½ mile west of Cullison, NW NW SW 12-28s-15w, flowed 1,500 M.c.f.d. from Cherokee at 4,,476-86 ft. The 1 Thompson, NE NE NW 22-28s-15w, a workover well, flowed 500 M.c.f.d. from perforations at 4,528-33 ft. The 1 Johnson, SW SW SE 25-28s-15w, opened Cherokee oil production in old Cullison field. It made 250 bbl. per day from perforations at 4,522-28 ft.

Kansas' Kiowa County bags new Mississippian gasser

Mississippian gas production is reported at a wildcat 1⅜ miles west of Fralick field in Kiowa County, southern Kansas. The discovery well is Falcon Seaboard Drilling Co. 1 Brensing, C SE SE 16-27s-20w, 6½ miles northwest of Mullinville.

Gas flowed at the daily rate of 5,020 M.c.f. during drill-stem test at 4,816-96 ft. Test was open 20 minutes. Final 30-minute bottomhole pressure was 1,626 psi.

Wildcat discovery finaled in southwestern Kansas

Stanton County has a new gas-producing area. Pan American Petroleum Corp. completed 1 Nicholas gas unit "C," 10 miles southeast of Johnson in C NE SW 15-30s-39w, 6 miles east of Shore field. Flow was 9,230 M.c.f.d. from Morrow perforations at 5,556-74 ft.

Marion County. Crowe Drilling Co. completed 1 Stenzel in NE NW NW 12-20s-3e, 1¼ miles southwest of Marion and 3½ miles

southeast of Dobbs field. The well flowed 2,500 M.c.f.d. from Mississippian perforations at 2,340-47½ ft.

Well scheduled for eastern Kentucky

In eastern Kentucky United Fuel Gas Co., Charleston, W. Va., has announced location for a wildcat test in Lewis County. Well is located on the Soldier topo sheet 19-W-75, 1,050 ft. from north line and 2,050 ft. from east line, and will be known as 1 Alice Shepherd. It will be drilled with rotary tools.

Kentucky's Boyd County test is failure

In Boyd County, eastern Kentucky, a test (first in many years) has ended in failure. Fontana Oil & Gas Co. has abandoned 2 L. C. Caldwell at a total depth of 2,502 ft. Well was located in the northeast section of the Bolts Fork Quadrangle. Formation tops released include Mississippian Big Lime, 761 ft.; Berea sand, 1,490 ft., and Corniferous lime, 2,170 ft. Several shows of oil and gas were noted but none of any commercial significance.

Wilcox discovery reported in Catahoula Parish, Louisiana

A new Wilcox Eocene field opened in Catahoula Parish, eastern Louisiana. Discovery is McGoldrick & Watson Drilling Co., and Hadson Oil & Gas Co. 1 Pinhook Plantation, C NW NW 33-6n-7e.

The well flowed 109 bbl. of 48°-gravity oil per day on 10/64-in. choke from perforations in the Wil-

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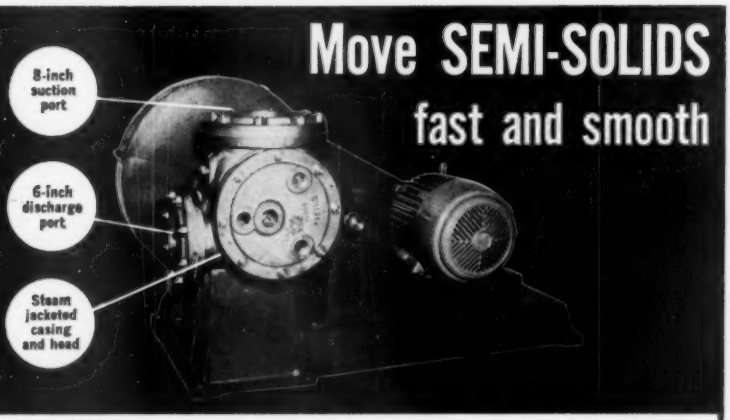

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cox at 5,463½-64¼ ft. FTP was 340 psi., FCP 120 psi., GOR 320:1. Well is producing from 8 ft. of saturated oil sand in the New Lake sand of Wilcox age.

The operators are rigging up at the No. 2 well, 1,320 ft. north of the discovery. Location of the new field is 2½ miles south of Lismore Landing field.

Michigan drilling may pick up

The winter slowdown in Michigan may be over.

The State Conservation Department announced 29 new permits to set a weekly high for the year and top any week for 1960. The new starts raised the year total to 152 compared to 201 for the same period last year.

Mississippian producer finaled at Lisbon, Utah

Pure Oil Co. completed 1 Northwest Lisbon-USA-E, NW SE 15-30s-24e, San Juan County, Utah, flowing 1,044 bbl. of oil daily through 25/64-in. choke. Production is from the Mississippian through perforations at 8,470 to 8,672 ft. This new well is in the south part of Lisbon field, ½ mile south of Standard Oil Co. of California's recent dual completion in Mississippian-Ouray Devonian.

Recompletion. The discovery well of the field, 1 Northwest Lisbon-USA-A, NE NW 10-30s-24e, is recompleted as a dual Mississippian Devonian producer. It originally made 587 bbl. of oil daily through 14/64-in. choke from McCracken Devonian at 8,251-8,348 ft.

New Clinton pool opens in Ohio

In southern Ohio, Harvey Starr has reported indications of a new Clinton pool in Mason Township, Lawrence County. This test, M. N. Taylor, Section 7, about 1½ miles north of production, found the Clinton sand at 3,384-3,400 ft. It had an estimated 200 M.c.f.d. natural and a gage of 2,090 M.c.f.d. with a rock pressure of 1,032 psi., 12 days after fracture.

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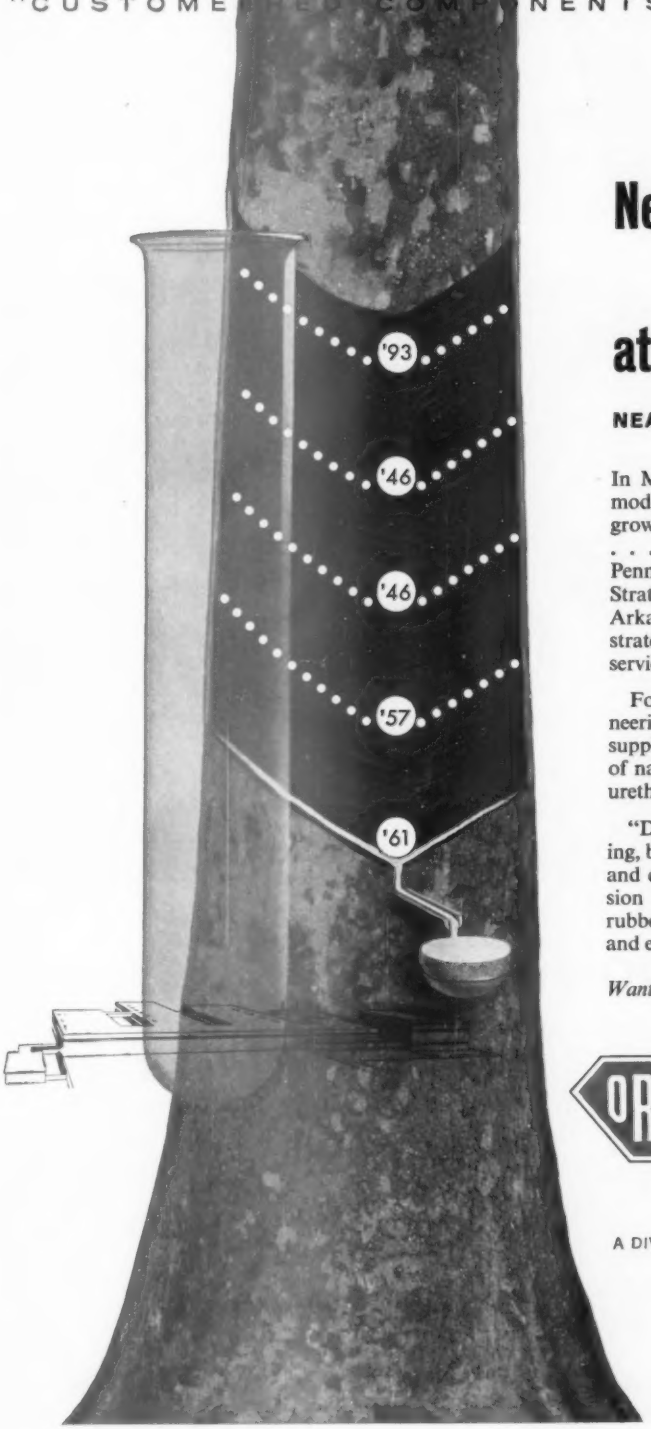

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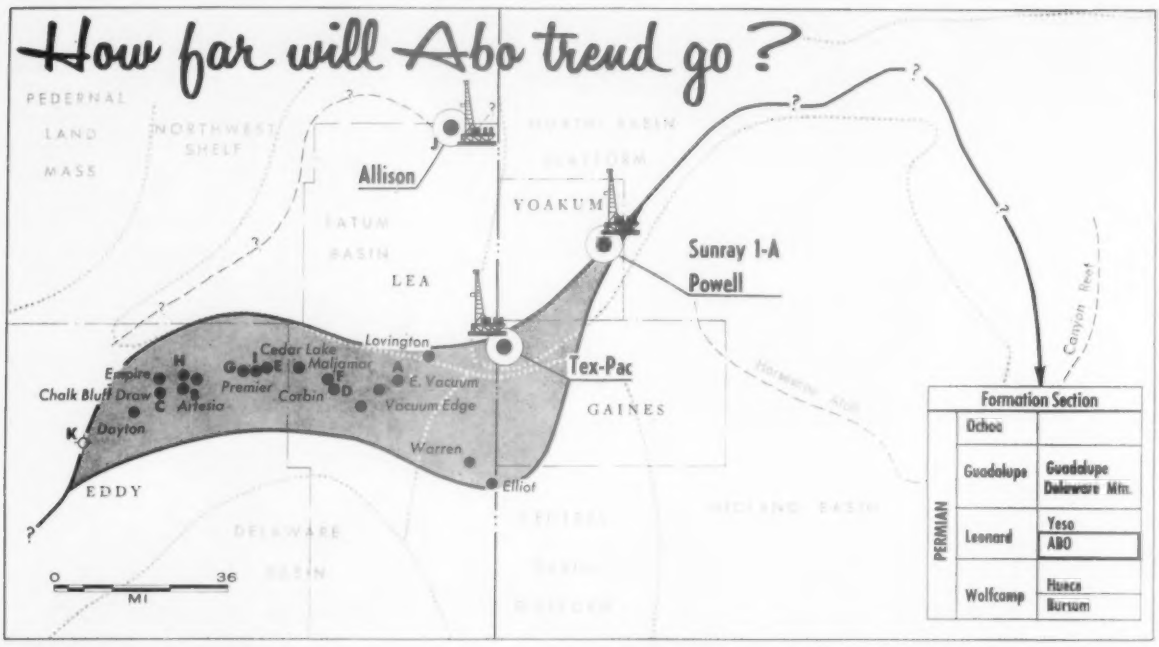


Recent discoveries

A. Amerada 1-VC State, 36-17s-35e. IPF 741 BOPD, 8,880-8,930 ft.
B. Pan American 1-BC State, Artesia field. IPF 92 BO 16 hours, 6,128-52 ft.
C. Humble 1 Abo-Chalk Bluff Draw unit. IPF 70 BO 13 hours, 5,600-28 ft.
D. Dunigan 1 Denius-Federal, Corbin field. IPF 502 BOPD, 8,710-53 ft.
E. Sinclair 65-A Turner "B," 20-17s-31e. Grayburg-Jackson field. IPF 288 BOPD, 7,120-50 ft.
F. Dunigan 1 Dennius, 33-17s-33e. IPF 60 BOPH, 8,596-8,675 ft.
G. Texas Pacific et al. 1 USA-Wooley, 21-17s-30e. IPF 20 BOPH, 6,750-6,830 ft.
H. Castle & Wigzell 1 Delhi-State, 33-17s-28e. IPF 96 BOPD, 5,890-5,930 ft.
I. Nash-Windfohr & Brown 22 Jackson "B," 24-17s-30e. Premier field. IPF 85 BOPD, 6,955-90 ft.
J. Gulf Oil Corp. 1 Federal-Mills, Allison field. IPF 152 BOPD, 8,970-90 ft.
K. Standard of Texas 1 Eugenia Bate-Federal, 3-20s-24e. Dry. Abo reef 4,136 ft.
L. Chambers & Kennedy 2 Delhi-Taylor-State, 34-17s-28e. IPF 456 BOPD, 6,289-99 ft.
M. Standard Oil Co. of Texas 2 Vacuum Edge unit. 4-18s-35e. IPF 240 BOPD, 8,650-8,720 ft.

Abo fields in New Mexico . . .

1. D-K Abo, Lea County. Discovered 1954. Three wells. 7,248 ft.
2. Dayton Abo, Eddy County. Discovered 1958. 10 wells. 5,280 ft.
3. Elliott Abo, Lea County. Discovered 1955. Two wells. 7,320 ft.
4. Empire Abo, Eddy County. Discovered 1957. 74 wells. 6,014 ft.
5. Lovington Abo, Lea County. Discovered 1951. 42 wells. 8,117 ft.
6. Malmajar Abo, Lea County. Discovered 1954. Abd. 1954. 8,980 ft.
7. Warren Abo, Lea County. Discovered 1954. 2 wells. 7,250 ft.
8. Chalk Bluff Draw, Eddy County. Discovered 1960.
9. Fren Abo, Eddy. Abo found in 1961.
10. Cedar Lake Abo, Eddy. Abo found in 1960.
11. Artesia Abo, Eddy County. Abo found in 1960.
12. Allison Abo, Lea County. Abo found in 1961. One well.
13. Corbin Abo, Lea County. Abo found in 1960.
14. Vacuum Edge Abo, Lea County. Discovered 1960.
15. East Vacuum field, Lea County. Discovered 1961. Two wells.

and in Texas.

1. Tex-Pac Abo, Gaines County. Abo found in 1960. One well, first in Texas.
2. Sunray 1-A Powell, Yoakum County. Discovered 1961. One well.

New Mexico's Abo touches Texas

BY JOHN C. McCASLIN

NEW MEXICO'S prolific Abo reef trend of lower Leonard (Permian) age has moved into Texas. A decade of Abo exploration on the northern shelf of the Delaware basin has given birth to one of the most active and successful drilling campaigns on the books today. No one took the Abo seriously until about 3 years ago. Since that time it has moved across the shelf from Dayton to Lovington in New Mexico, thence to Tex-Pac and now eastern Yoakum County in Texas.

A dry hole on the southwest end

. . . of New Mexico's Abo reef trend may hint the limits of this Permian oil play in Eddy County, but it needn't throw cold water on the brisk hunt for Abo oil from that point east and northeastward across Lea County into Texas. Several attempts have been made in recent months to pin down the Abo's extent in southwestern Eddy County. Latest try is Standard of Texas 1 Eugenia Bate-Federal in 3-20s-24e (K on map). This wildcat failed at 4,220 ft. Abo shale was found at 4,069 ft., the reef at 4,136 ft. Texas Crude Oil Co. 6 Huapache will be the next try in 6-23s-22e. This well will look for Abo to 4,300 ft.

Oil hunting in the middle

. . . of the Abo reef trend has unearthed 17 fields since 1951. Most of these have been found in the past 3

years. Some are out and out new fields, others are new-pay discoveries inside famous old New Mexico pools like Lovington, Artesia, Empire, and Vacuum. Abo production was first found in December 1951 in Lovington field. Then came Abo oil production at Empire field in 1957. This discovery sparked the current Abo boom. More than 200 producers are expected here before final definition. Proved oil reserves are well over 65,000,000 bbl.

One of the most interesting wildcat discoveries of late is Gulf Oil Corp. 1 Federal-Mills (J on map), original discovery of Allison Pennsylvanian field in northern Lea County. This well was recompleted as an Abo discovery for 152 bbl. of oil and 6 bbl. water daily on 24/64-in. choke at 8,970-90 ft. Location is 46 miles north of nearest Abo production on the trend at Lovington. The Gulf well raises the question of another Abo trend on the northern flanks of Tatum basin.

Texans ponder the Abo

. . . with two discoveries as a base. Last year first Abo production for Texas was found at a wildcat in Tex-Pac field, Gaines County. This year Sunray Mid-Continent Oil Co. tapped Abo some 25 miles northeast at 1-A Powell in Yoakum County. It is still too early to evaluate these discoveries. Both have caused considerable speculation as to the extent of Abo possibilities in Texas. Much thought is being given a possible projection of Abo reefing northeastward along the east part of the north basin platform to the Matador arch, and then southeast along the western side of the eastern shelf.

Abo exploration has joined the ranks of leading objectives in the vast Permian basin province. Wildcatters are looking for deep Pennsylvanian, more Devonian, and the Abo. All three hunts have thrust West Texas-Southeast New Mexico back into the list of "active areas."

AFFIXING a few thousand of the 6,778 signatures needed to complete Pure Oil Co.'s purchase of nearly 400,000 acres of oil-lease land in the Bristol Bay basin in Alaska are, left to right, Jan Koslosky, Petroleum Development Co.; Frank Shogrin, Pure; Herb Hilscher, Great Western Development Co.; Mrs. Thelma Ross and Garth Armstrong, Pure, and Harold Koslosky, Koslosky Development Co.

New Mexico's Cha Cha field gets southeast extension

The most southeasterly well in Cha Cha field, San Juan County, northwestern New Mexico, is Aztec Oil & Gas Co. 10 Robinson-G, C SE NE 22-28n-13w.

The new producer flowed 88 bbl. of oil daily through 28/64-in. choke from Gallup Cretaceous through perforations at 5,764-5,836 ft.

Strawn oil flows at offset to Lusk Deep unit

El Paso Natural Gas 2 Lusk Deep unit, northwest offset to the 1 Lusk Deep unit Bone Spring and Strawn discovery in southwestern Lea County, Southeast New Mexico, flowed oil from the Strawn at 11,222-52 ft.

The well made 640 bbl. of oil per day on ¼-in. choke from the Strawn. Earlier, through Morrow Pennsylvanian at 12,380-96 ft. the well flowed 4 M.M.c.f.d. through ¼-in. choke.

Another pool for southern Ohio

Activity in southern Ohio indicates another pool opener in Gallia County. The operators, H. H. & R. Oper. Acct., reported Clinton pay in the 1 John W. Gills, Section 28, Perry Township, was found from 3,414-24 ft. with 300 M.c.f.d., natural. In a test 14 hours after fracture, gage was 3,090 M.c.f.d. and rock pressure 1,175 psi.

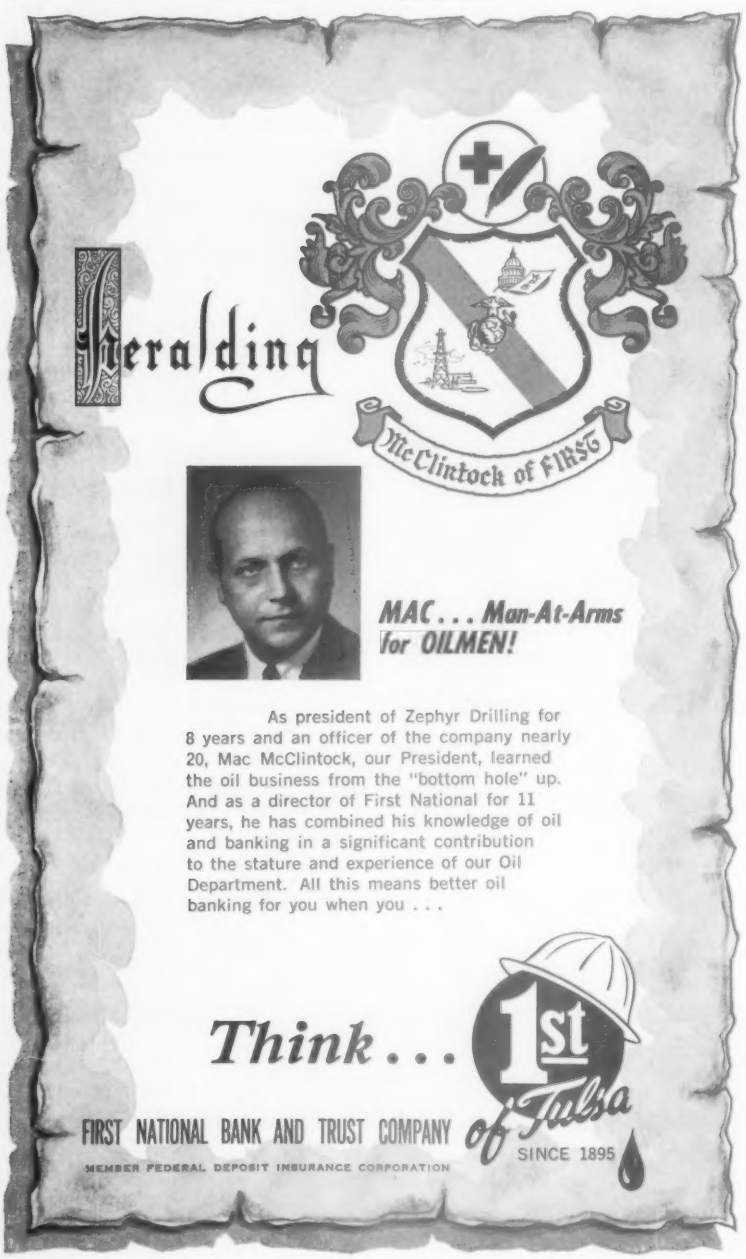
This wildcat marks the first success in the township. Action here has been limited to two previous Clinton tests drilled more than 30 years ago that were dry.

Sooner's Custer County due deep wildcat test

A deep wildcat will go down in Oklahoma's Custer County. Sunray Mid-Continent Oil Co. will drill 1 Hatcher Estate in C SE NE 1-14n-18w, in the midst of a huge solid block of Sunray leases.

This new wildcat is about 4 miles south of Northwest Anthon field, a newly opened gas area. There has been no previous deep drilling in the area for several miles around. This will be a closely watched test in western Oklahoma.

Dewey County. Sinclair has completed 1 Sarkeys unit, C SE NW 13-17n-18w, flowing 120 bbl. of condensate in 12 hours and 10,877 M.c.f.d. through ¾-in. choke from perforations in the Oswego Pennsylvanian at 9,118-68 ft. Location is in West Valley Center field, currently undergoing brisk development.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More gas reported at Arkoma basin prospect

Gas flow from Spiro is reported at Frankfort Oil Co. 1 Hulsey, NW NW SE 18-6n-22e, Norris Deep field, Latimer County, Southeast Oklahoma.

The well flowed 900 M.c.f.d. on a short test through ⅛-in. choke from perforations at 11,660-11,707 ft. On a 10/64-in. choke it made 1,500 M.c.f.d., and a 12/64-in. opening it flowed 2,350 M.c.f.d. On ¼-in. choke it flowed 4 M.M.c.f.d. No pressures were reported on this last flow.

Oil discovery completed north of Kingfisher play

A new oil pool was opened 2 miles north of East Hennessey field in Garfield County, northern Oklahoma. The well is National Associated Petroleum Co. 1 Gabriel, C NE NE 27-20n-6w.

Flow rate was 235 bbl. of 38°-gravity oil per day on 30/64-in. choke from open hole in the Mississippian at 6,631-6,742 ft. In East Hennessey field itself, Kingfisher County, Keener Oil Co. dually completed 1 Church of Christ in Christian Union, C SW NE 1-19n-6w. It flowed 158 bbl. of oil in 6 hours on 20/64-in. choke from Cleveland sand at 5,780-5,808 ft., then made 110 bbl. in 8 hours from Meramec open hole at 6,518-6,648 ft.

Caddo conglomerate hit completed in North Texas

A Caddo conglomerate discovery is reported at Bennett Oil Co. 1 Morgan Jones Estate "B," southwestern Montague County. Location is 5½ miles southwest of Bowie and 1½ miles northeast of MPS

Ellenburger and Irons Viola field.

The new-pay discovery flowed 225 bbl. of 41°-gravity oil per day on 20/64-in. choke from perforations at 5,761-71 ft. Jones Caddo will be the field's name. Nearest production is 1½ miles southwest of Eanes Caddo field. Location is in Milby Berry Survey, A-23.

Independent hits on first '61 Canada try

In Canada, Zapata Petroleum Corp., one of the more active independent American oil operators in Alberta in 1960, has started 1961 off with a bang as its first drilling venture in this year's project discovered light-gravity oil.

Although the company's prime interest in Alberta operations is the discovery and development of natural gas, the recent bonus must be highly desirable. The discovery well, Zapata - CPOG 10-12 Hussar is close to highly productive gas wells and, in fact, the whole Hussar region that lies about 60 miles due east of Calgary is noted for gas development rather than oil.

In addition to its proximity to gas completions, this oil find is about 3½ miles north-northeast of a previous Glauconitic oil completion and is 5 miles southeast of the Rosebud area Glauconitic oil pool. An oil - producing sector of the Wayne-Rosedale gas field lies 4 miles northeast of the Zapata discovery well. Thus it is really apparent that the region is potential hunting ground for both oil and gas. Although this type of oil accumulation does not represent anything entirely new for the area, the very favorable flow rate of 20 bbl. per hour on initial drilling test, coupled with the estimate of 30 ft. of effective oil pay zone in the Glauconitic make this strike one of the best looking in the area.

Hussar. Zapata-CPOG 10-12-27-21 Hussar, on LSD 10, 12-27-21w4, was drilled by Zapata on petroleum and natural - gas lease rights acquired under farmout agreement from Canadian Pacific Oil & Gas Co., Ltd. The oil pay—Glauconitic—was topped at 4,470 ft., 1,700 ft. below sea level based on K.B. 2,770 ft., and drill-stem test of the interval 4,465 to 4,500 ft. with valve open 30 minutes flowed light-gravity oil at the 20-bbl. per hour rate. This well will be drilled to look at the Mississippian. After evaluation of that lower prospective zone completion procedure will be determined. At last report the well was near its projected depth of 4,800 ft.

This Hussar discovery was Zapata's first test in 1961. The well was drilled in a sizable farmout block from Canadian Pacific Oil & Gas (the oil and gas operating unit of Canada's Canadian Pacific Railway Co.) and it is anticipated that at least 11 more wells will be drilled on this farmout this year. Although full details of the agreement between the two firms haven't been disclosed it is understood that Zapata has drilling options that will earn it interests in upwards of 20 sections in this area.

In addition to this Hussar Canadian Pacific deal we can look for Zapata to initiate second stage of its exploration and development play on its very large British American Oil Co., Ltd., farmout at Stettler-Forestburg in Central Alberta

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Canada completions—March 1961

	Total wells						Wildcats					
	Total	Oil	Gas	Dry	Service	Footage	Cum. wells 1961	Total	Oil	Gas	Dry	Footage	Cum. wells 1961
Western Canada	208	95	41	68	4	1,173,468	584	73	13	17	43	420,219	202
Alberta	134	55	30	47	2	861,945	381	48	8	10	30	291,608	129
Saskatchewan	44	33	0	10	1	158,867	124	7	4	0	3	25,620	18
Manitoba	5	4	0	0	1	9,936	9	0	0	0	0	.....	1
British Columbia	22	3	10	9	0	126,349	61	15	1	6	8	86,620	45
Northwest Territories	3	0	1	2	0	16,371	9	3	0	1	2	16,371	9
Ontario	19	6	8	5	0	18,318	62	...	...	...	...	.....	...

in the very near future. The company drilled 14 tests in 1960 on this B. C. project and came up with a 50-50 score on gas completions and dry holes. About 12 more wells could be drilled on this project this spring and summer. A drilling program of this magnitude—at least two dozen wells—will keep two or three rigs active most of the summer and a good ratio of success will likely foster additional drilling by other landholders in the two general areas.

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unit coats and wraps as it travels along 24" pipe

The unit shown speeds one of the toughest jobs in the oil fields. Powered by a 37-hp VG4D Wisconsin Engine, the travelling machine coats and wraps 24-inch pipe against corrosion breakthrough in one cost-cutting run.

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The Wisconsin-powered unit applies the coating and then wraps the pipe with either glass wrap, felt, or slant or kraft paper as it power-crawls along the line.

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Discovery wells

WESTERN CANADA

Alberta:

Canpet L-M CPOG 10-20 Rosebud, LSD 10, 20-27-22w4. Glauconitic gas discovery. TD 5,200 ft. Imperial-Canadian Superior 6-22 Pendryl, LSD 6, 22-45-5w5. Pekisko gas discovery. TD 7,106 ft.

DD2 Swan Hills, LSD 12, 14-65-10w5. Beaverhill Lake oil discovery. TD 8,319 ft.

Imperial et al. 11-4 Pendryl, LSD 11, 4-45-5w5. Pekisko gas discovery. TD 7,280 ft.

Kissinger et al. 10-21 Gladys, LSD 10, 21-20-27w4. D1 gas discovery. TD 8,441 ft.

Pan American-B.A. DD28 Swan Hills, LSD 10, 21-65-10w5. Beaverhill Lake oil discovery. TD 8,740 ft.

Union 4-14 Zama Lake, LSD 4, 14-111-9w6. Watt Mountain gas discovery. TD 6,620 ft.

NEBRASKA

Dundy County, Pierce Lake:

Sunray Mid-Continent Oil Co. 2 Stroup, OWWO OTD 4,450 ft., C SE SE 8-2n-37w. IPP 15 BOPD, Admire Permian 3,790-96 ft. TD 4,450 ft. First Permian producer in Nebraska. 1 State-B, C SE NW 36-3n-38w. IPP 47 BOPD, Lansing-Kansas City 4,248-4,304 ft. TD 5,067 ft. Lansing-Kansas City discovery, new field.

OKLAHOMA

Noble County:

Olympic Petroleum Co. 2 Warren Case "A," SE SW SE 7-24n-1e, 2 miles east of Tonkawa pool. IPF 3 BOPH, 7 hours, 19/64-in. choke plus 2,310 M.c.f.d., FTP 935 psi., FCP 1,044 psi., 41°, Skinner sand notch cut 4,246 ft. TD 4,298 ft. New oil discovery.

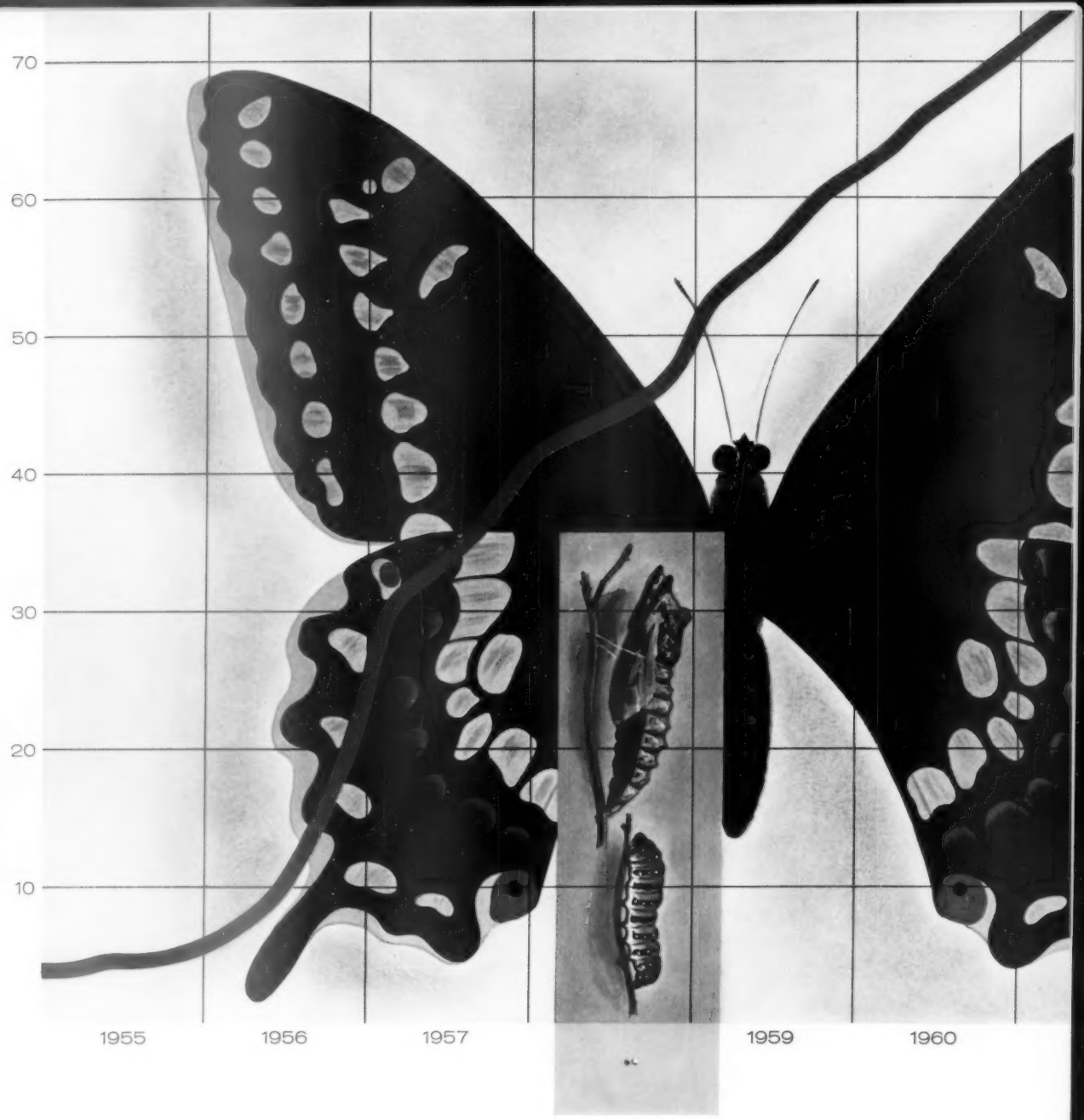
LeFlore County:

Midwest Oil Corp. 1 Floyd Morris, SW NE 12-8n-26e, 1½ miles west of Rock Island. IPCOF 2 M.M.c.f.d., Atoka sand 5,205-62 ft. TD 9,216 ft. New gas discovery, revives abandoned Rock Island field.

SOUTHWEST TEXAS

Duval County:

Shell Oil Co. 1-A Lee Hubbard, Section 83, BS&F Sur., A-112, 4 miles southeast of Freer. AOF 550 M.c.f.d., dry gas, shut-in TP 740 psi., perf. 2,806-13 ft., Jackson. TD 7,001 ft. Wildcat discovery in Loma Novia area.



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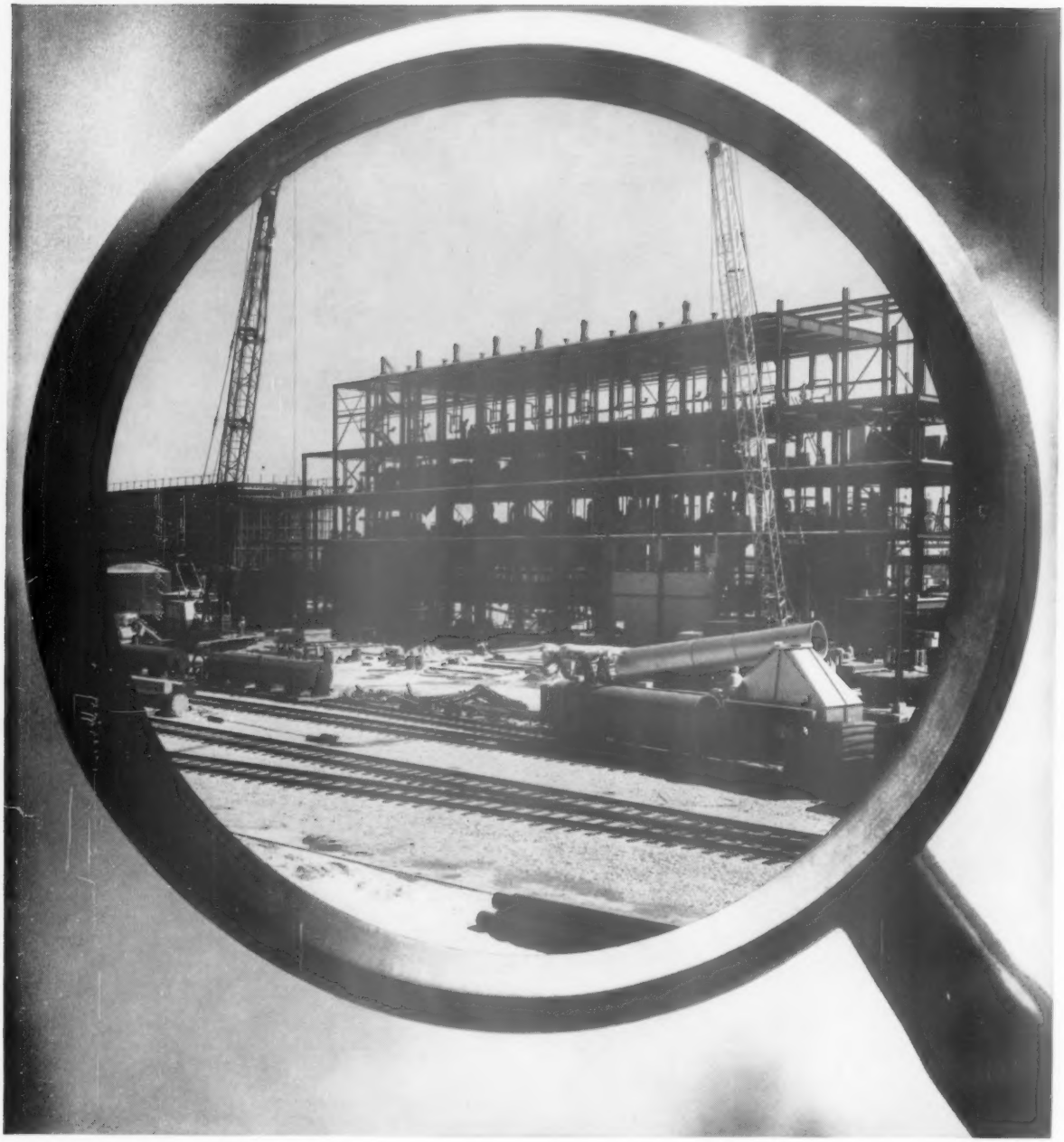
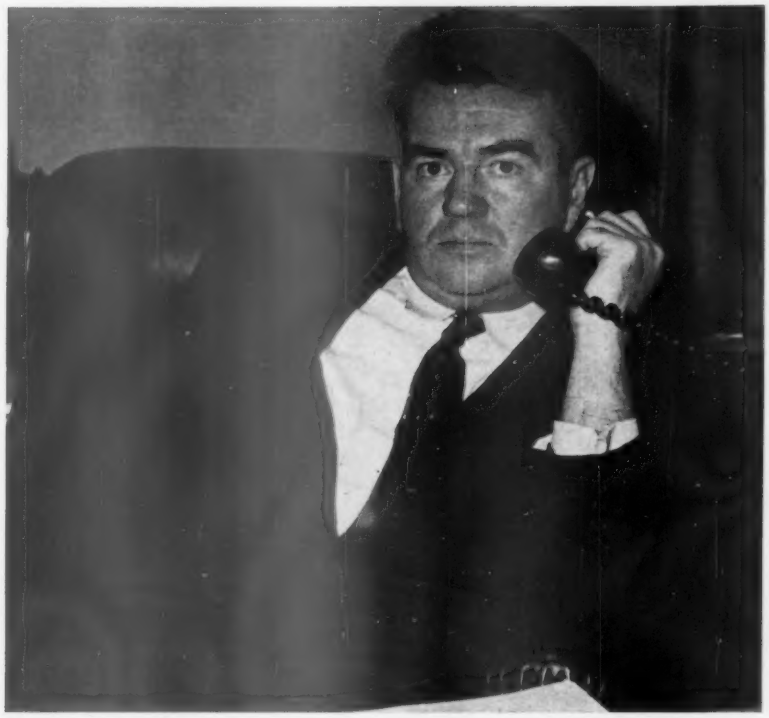


FLASH! Beaumont, Texas: Houston Chemical makes the news with its new, multimillion dollar gasoline-additive plant, set to go on stream here in July—way ahead of schedule. This plant's output of tetraethyl and tetramethyl lead will make Houston Chemical the country's third largest producer of these additives. Also included in the Beaumont petro-chemical complex will be an 80-million pound per year ethylene oxide plant—largest single unit of its kind ever constructed. This plant's glycol production will go into private label anti-freeze brands as well as bulk shipments. For further information, write Houston Chemical Corporation, 200 Madison Avenue, New York 16, New York.

HOUSTON

HOUSTON CHEMICAL CORPORATION



John M. Kelly . . . long-range thinking is what's needed.

Interior's Kelly Shows Zeal

. . . for his new job as assistant secretary for mineral resources. He thinks it deserves all-out enthusiasm.

HAVING run $6,000 from the sale of his home up to what he calls a "comfortable" amount as an independent oil operator in New Mexico since World War II, John M. Kelly has now settled down in Washington to be a bureaucrat for a few years.

Why?

He feels the post he accepted—assistant secretary for mineral resources at the Interior Department—offers an important challenge. Handled right, it could be highly beneficial both to industry and the Government.

Kelly notes that in peacetime, industry people are apt to drift out of Washington—leaving a shortage of capable men with technical knowledge.

He figures that his background in oil production conservation, association work, and other aspects of oil and minerals (OGJ, Feb. 20, p. 85) can be put to good use.

"There's been nobody here in government in recent years to stand up for the industry and tell the facts about it," he says.

Also, Kelly considers that a man should be willing to devote some time to serving his government.

Viewpoint . . . What does he think the Government should be doing in regard to minerals?

"For one thing," Kelly explains, "the old-line departments, such as Interior, should put more emphasis on long-range programs and less on 'crash' programs.

"The so-called surpluses of oil, copper, and other essential minerals today could well become the shortages of tomorrow unless we develop long-range programs. And perhaps a more realistic long-range approach to these problems would reduce many of the day-to-day headaches."

He thinks the Government should do more basic research to set the stage for industrial improvements.

"For instance, we haven't developed a really new tool for finding oil since the seismograph," he says. "I think Interior should be working on projects like that."

The new assistant secretary has been revealing this type of thinking to various bureau chiefs under his jurisdiction at Interior. He says he has been pleased by "the wonderful response."

Kelly is acutely aware that Interior is grappling with some "immediate" problems—such as import controls—and he knows that much of his time will be spent on them at first. But he hopes to put more and more emphasis on long-range aspects.

He does not claim to be an expert in all phases of the mineral industries, even oil. And he is particularly aware of his lack of experience in international aspects of these problems.

"On the spots I'm weakest in, I'll get the best help I can from the experts," he says.

Energetic type . . . Kelly, 46, brims with the energy that carried him through 12-hour work days when he and his wife were building up his oil operations in New Mexico from scratch.

"I'm not going to make a career out of this government business," he declares. "I'll be going back to New Mexico one day and I hope that my work in Washington will have contributed a little to making the industry I'll return to an even stronger, healthier one—still full of opportunity."

Washington veterans look skeptically at newcomers full of vim and vinegar. But there appears to be a gleam of approval in the glances they have been turning on Kelly in recent weeks.

●

W. H. Hudson, who was president of Three States Natural Gas Co., has been elected president and general manager of Stekoll Petroleum Corp., Dallas. Three States is being acquired by Delhi-Taylor Oil Corp. **James A. Barnett,** of W. H. Hudson Co., has been named general operating executive of Stekoll, and **Joseph B. Avant,** W. H. Hudson Co., has been named Stekoll senior fiscal officer.

▶▶▶ Personals

BALDRIDGE

Earl Baldridge, president of Champlin Oil & Refining Co., has been elected chairman and chief executive officer. He will continue as president. **Richard Wagner,** former chairman, has been named chairman of the executive committee. Wagner recently was named president-elect of the U. S. Chamber of Commerce.

Dr. Bruce C. Netschert, government and industry consultant on oil and gas economics, will receive the 1961 recognition award of Texas Independent Producers and Royalty Owners Association. The annual "Hat's Off" trophy will be presented at Tipro's annual meeting May 14-16 in Midland, Tex.

L. E. (Ed) Gould, manager of the sales - development department in Shell Chemical Co.'s ammonia division, has been named manager of the division's ammonia department. He succeeds **J. F. Kroeger,** recently transferred to New York as sales manager in the industrial-chemicals division.

Louis M. Ayers, special assistant to Continental Oil's general manager of production, has been promoted to regional superintendent of natural-gasoline and gas operations for Conoco's CATC marine region. He succeeds **F. T. O'Leary,** recently named production manager for the CATC region. Ayers will continue to headquarter in Houston.

H. N. Sweeney, general manager and vice president of Featherstone Corp., Roswell, N. M., producing firm, has resigned to open offices as consulting geologist in Roswell.

Edward Horning has joined Phillips Chemical Co.'s Phillips, Tex., plant as development chemist.

Dr. George Lopatin has been named chemist in the plastics-products department of Shell Development Co.'s Emeryville, Calif., research center.

W. A. Bramlette, assistant manager of Humble's exploration department in the Central region, Tulsa, has been transferred to the Houston headquarters exploration staff as coordinator of special studies. **W. M. Rust, Jr.,** assistant chief geophysicist in the Southwest region, has been named coordinator of department services, Houston. **T. P. Woodward,** Oklahoma City area exploration manager for Humble, has been named chief geologist for the Central region. **Robert W. Beck,** who had been regional chief geologist in Tulsa, will take over as Oklahoma City area exploration manager.

S. S. McKeen, president of Alberta Pacific Consolidated Oils, Ltd., Calgary, has been named chairman. **W. G. McMahon** has been named president. Other officers are **R. S. Rapp,** executive vice president; **G. B. McKeen,** financial vice president; **D. B. McDougall,** exploration vice president; and **M. James,** secretary-treasurer. Members of the executive committee are Rapp, McDougall, S. S. McKeen, G. B. McKeen, W. G. McMahon, and **G. L. McMahon.**

Don W. Conaway, manager of British-American Oil Producing Co.'s gas and gasoline section, has been named manager of oil and gas sales and purchases with headquarters in Dallas. He succeeds **Myron Messner,** who has retired. In the new post Conaway will negotiate sales contracts for natural gas and LPG, will approve investments in processing facilities, and supervise purchase of oil and condensate by Toronto Pipe Line Co., a subsidiary. He will also market oil and condensate produced or purchased by B-A and Toronto.

CONAWAY

William J. Zeman has been elected vice president, general counsel, and member of the executive committee of Phillips Petroleum Co. Zeman recently was elected a director. **Lloyd G. Minter,** assistant general attorney, has succeeded Zeman as general attorney.

J. C. Slonneger, Dallas, retired Continental-Emsco mechanical engineer, was first recipient of a new petroleum production award at the West Texas Oil Lifting Short Course of Texas Technological College. The award, which will be named in honor of Slonneger, will be presented annually. Slonneger was cited particularly for his work in development of sucker rods which have made deep pumping possible and for his design of an economical single-cylinder, horizontal pumping engine.

P. M. Konkel, assistant chief geologist in Ohio Oil Co.'s domestic production headquarters, Findlay, Ohio, will become division geologist in the expanded Tulsa production division about July 1. **R. K. Bowles,** division geologist in Tulsa, and **R. A. Koenig,** Shreveport, La., division geologist, have been named senior staff geologists in the Tulsa division. In other changes resulting from consolidation of the Tulsa and Shreveport divisions, **G. R. Baldwin,** Shreveport division land man, has been named Tulsa division land man. **D. W. Akins, Jr.,** Shreveport division petroleum engineer, will hold this post in the Tulsa division. **R. J. Grubb,** acting Tulsa division land man, has been named assistant Tulsa division land man, and **F. V. Kluck,** Tulsa division petroleum engineer, will be assistant division petroleum engineer. **F. C. Crawford,** assistant to the manager of the Shreveport division, and **W. C. Sylvester,** assistant Tulsa division petroleum engineer, will be assistants to the Tulsa division manager. **H. N. Lewis,** Tulsa division production superintendent, and **H. H. Harris,** division attorney in Tulsa, will continue to hold these posts. Consolidation of the two divisions is expected to be completed by September 1.

Dr. John G. McNab has been named chairman of new-use activities and chairman of the new-use advisory committee of Standard Oil Co. (N. J.). He had been with Esso Research & Engineering Co.

Aaron Cawley and **Jimmie D. Harrington** have formed Cawley & Harrington, Petroleum Engineering Consultants, in Fort Worth. The new company will specialize in reservoir studies, reserve estimates, and property evaluations and appraisals. Both men were formerly with Keller & Peterson, consulting firm.

Duncan V. Patty, manager of Anderson - Prichard Oil Corp.'s economics and evaluation department in Oklahoma City, has joined Tejon Ranch Co. as assistant vice president in charge of oil and mineral development, a new post. He will headquarter in Fort Tejon, Calif.

J. S. Newman, chief civil engineer for Plymouth Oil Co., has been transferred to Houston from Sinton, Tex.

Jacob G. Tolpin, technical associate at American Oil Co.'s Whiting, Ind., laboratories, has retired after 14 years with the company.

James W. Kerr, president and chief executive of Trans-Canada Pipe Lines, Ltd., has also been elected chairman of the board. Kerr became president when he joined Trans-Canada in 1958.

John W. Lee, superintendent of Sohio Pipe Line Co.'s eastern division in Mooresville, Ind., has been named general superintendent of the eastern region and the products pipeline region. He will headquarter in Fostoria, Ohio.

James A. Jordan, electrical engineer with Platte Pipe Line Co., has joined Jayhawk Pipeline Corp., Wichita, as staff engineer.

Richard E. Bayne, assistant district superintendent for Hope Natural Gas Co. in McWhorter, W. Va., has been named district superintendent in Clarksburg, W. Va. He succeeds **R. F. Rader,** who has retired.

Harry M. Hunter, general manager of Canadian Western Natural Gas Co., has been elected a director.

C. W. Painter, senior partner of Cravath, Swaine & Moore, New York law firm, and **A. Charon,** who recently resigned as president of Shell Francaise, have been nominated to fill vacancies on the Royal Dutch Petroleum Co. board. They will succeed **J. B. Aug. Kessler** and **C. J. Baron Collot d'Escury,** who will resign as directors June 30. Painter's law firm has been legal adviser to various Royal Dutch-Shell firms since 1912. Painter will be the first American to be elected a director of Royal Dutch Petroleum.

Bert Folda, Jr., has been appointed manager of new projects and studies for Mobil International Oil Co.'s manufacturing department.

Russell H. Green, Jr., Signal Oil & Gas Co., has been elected a director of Oil Producers Agency of California, independent oil producers association.

Leonard R. Woolsey, general manager of marketing for British American Oil Co., Ltd., has been named vice president of marketing.

Thomas N. Ambrose, geologist with Kewanee Interamerican Oil Co., has been transferred to Coral Gables, Fla., from San Juan, Puerto Rico.

Donald W. Buchanan, superintendent of Continental Oil's Illinois basin district in Carmi, Ill., has been promoted to assistant production manager of the central region. He will headquarter in Oklahoma City.

Eugene Runes has joined American Oil Co.'s research and development department in Whiting, Ind., as senior project engineer.

A. L. Kash, production engineer for Humble in Great Bend, Kans., has joined the Bureau of Mines as natural-gas engineer in Amarillo, Tex.

Arnold Dan Buzzalini, senior geologist in Skelly Oil Co.'s Albuquerque district office, has been promoted to senior research geologist and transferred to the Tulsa headquarters office.

▶▶▶ Personals

Van Thompson, executive vice president and a director of Aztec Oil & Gas Co., has been elected president. He succeeds **Wofford Cain,** who has been Aztec president since the company was organized in 1954. Cain has been named chairman. **Edward M. Anderson,** Aztec's chief geologist, has been elected vice president in charge of exploration. Thompson was manager of exploration and chief engineer for Southern Union Gas Co. before joining Aztec.

THOMPSON

Jim Dowdy, Texaco, has been elected president of East Texas Geological Society. He succeeds **Dr. Paul H. Nichols,** Shell. Other new officers are **Dick McKeller,** British-American Oil Producing Co. vice president; **G. W. (Jake) Thomas,** Atlantic, secretary; **Roy C. English,** Ohio Oil, treasurer; and **Stedwell Johnson,** Shell, executive committeeman.

R. S. Hebberd, Pembina district superintendent for Mobil Oil of Canada, has been appointed joint-interest manager with headquarters in Calgary. **J. A. Kelly,** chief of the production and drilling section will succeed Hebberd.

Robert R. Chastain, Kansas City regional manager for Cities Service Oil Co.'s marketing division, has been named manager of wholesale sales in New York.

E. L. Upham, manager of Mobil Oil Co.'s gas-liquids division, crude-oil and gas-liquids department in Dallas, has retired after 43 years with the company.

D. E. Bacon has resigned as district geologist in Houston for Atlantic Refining Co. to open offices as consulting geologist there.

John E. Hinman has been appointed group leader in American Oil Co.'s research and development department, Whiting, Ind.

Personals

Joseph G. Evans, manager of the Cleveland district office in Du Pont's petroleum - chemicals division, has been named assistant manager of tetraethyl lead and planning for the petroleum-chemicals division.

K. E. Teague, Minot, N. D., consultant, has joined Cardinal Petroleum Co. as district geologist. He will open offices for the company in Billings, Mont.

D. E. Covey, Shell, has been elected president of California Coastal Landmen's Association, a chapter of American Association of Petroleum Landmen.

W. Ray Keller, geologist with the California Co. in Harvey, La., has joined Tenneco Oil Co. in Corpus Christi, Tex., as geological engineer.

J. A. Rowe, Jr., has joined Magna Chemicals, Inc., as East Texas district manager in Kilgore, Tex. He formerly was with Gulf Oil Corp. in Houston.

George R. Elliott, New York petroleum consultant, has set up his headquarters office in Santa Monica, Calif.

James W. Erickson, engineer in Humble's Esso Standard division office in New York, has been transferred to Houston as planning coordinator.

F. G. Bannerot III, assistant to the president of Elk Refining Co., Charleston, W. Va., has been elected a director of United Refining Co., Warren, Pa.

H. J. Horsch, director of supply and transportation for Tenneco Oil Co., and **David B. Chalmers,** director of crude-oil purchases and sales, have been elected vice presidents.

Herbert Schuyten has been promoted to senior research engineer in the process-planning section of California Research Corp.'s Richmond, Calif., laboratory.

J. D. Ratcliffe, formerly of Hunt, Ratcliffe & Gray, Calgary consulting firm, has joined Skelly Oil Co.'s geological department in Calgary.

Robert C. Davidson has been named technical director of Nalco Chemical Co.'s catalyst division.

Dr. William E. Bradley, director of research for Union Oil Co., has been elected a vice president. He will continue to direct research. Bradley joined Union in 1931 as an associate chemist. He had been assistant to the vice president of research and manager of refining research before becoming research director.

John G. Yeager, operations superintendent for Humble's eastern area in New Orleans, has been promoted to manager of the crude-oil department in Houston.

Arthur L. Brown, manager of production for Shell Trinidad, Ltd., in Point Fortin, Trinidad, has been transferred to New York as senior exploitation engineer for Shell Oil Co.

Alistair S. Couper has been named project supervisor in American Oil Co.'s Whiting, Ind., research and development department.

Deaths

Frank B. Markle, 53, senior vice president of Union Texas Natural Gas Corp., **James V. Kelley,** 37, senior geologist for Union Texas Natural, and **Glen R. Neighbors,** 43, vice president of Taylor & Associates, geological consultants, were killed in a plane crash April 19 in Iran. The crash occurred near Isfahan, about 200 miles south of Tehran.

Pleas O. Hardwick, 63, nationally known independent oil broker, died April 20 in Shreveport, La. Hardwick headed Cargoes, Ltd., Shreveport, and at one time was a vice president of Atlas Processing Co. He had been active in oil marketing and brokerage since the 1920's.

Don W. Jones, 38, Tulsa representative and vice president of Thunderbird Drilling Co., Wichita, died April 19 in an East Lansing, Mich., hospital. Jones was an independent operator before joining the drilling firm in January.

Dr. Roy R. Morse, Houston consulting geologist, died April 20 in Houston. Morse was with Shell Oil before becoming a consultant in 1953. He was Shell's area manager in Houston at one time.

Charles H. Maston, Sr., 67, a retired sales manager for Socony-Vacuum Oil Co., died April 12 in Sebring, Calif.

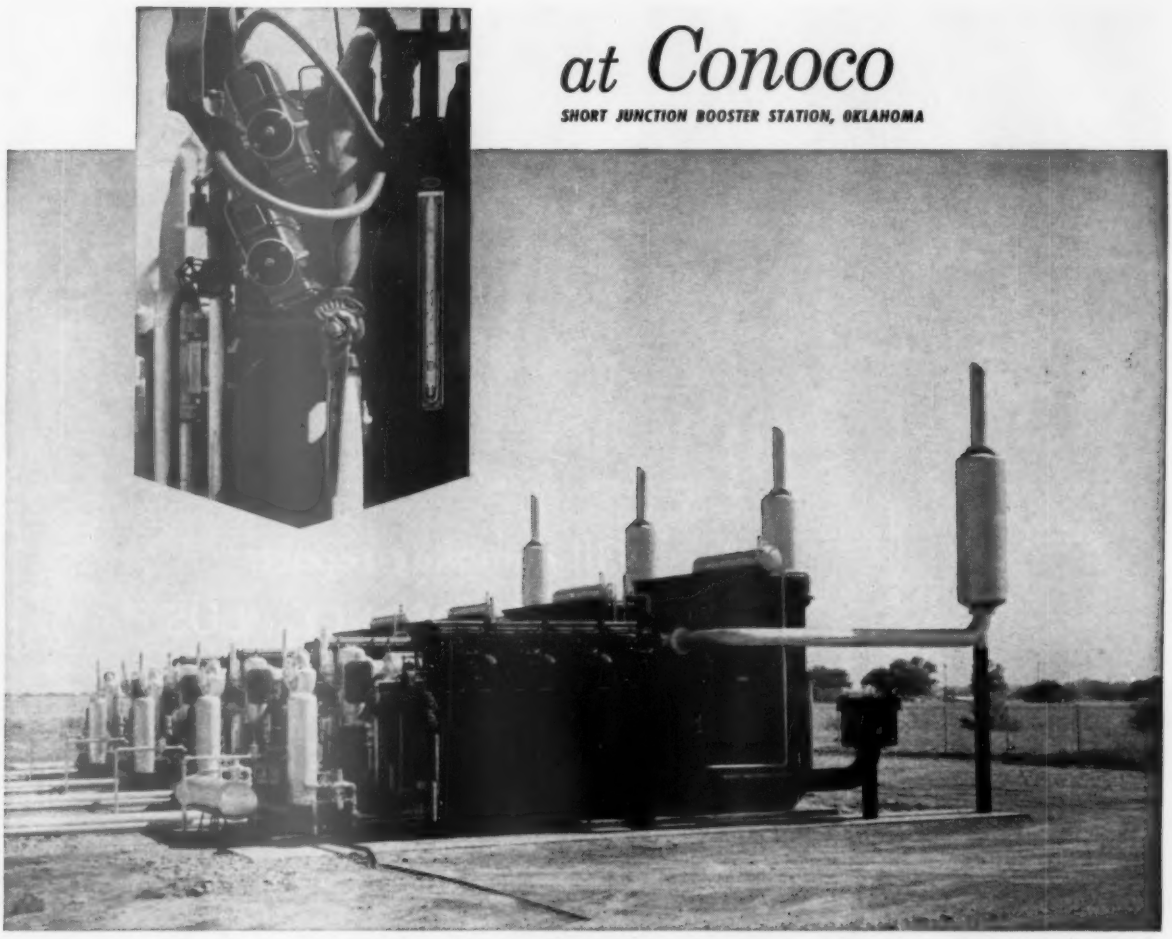
Harry E. Melton, 71, retired superintendent of Sun Oil's Marcus Hook, Pa., refinery, died April 12 in a Philadelphia hospital. Melton retired in 1957.

Thomas C. Argue, 73, pioneer Oklahoma oil man, died April 25 at his home in Tulsa of a heart ailment. Argue retired in 1954 after 37 years with Johnson Oil & Gas Co., Cleveland, Okla.

Carl W. Marquis, 71, a retired maintenance superintendent with Shell Pipe Line Co., died April 12 at his home in Altadena, Calif. Marquis was serving in Shell Pipe Line's Texas-Gulf division before retiring in 1946. He joined the company in 1918.

Douglas S. Bushnell, 87, retired president of Buckeye Pipe Line Co., died April 20 in a Morristown, N. J., hospital after a heart attack. Bushnell entered pipelining in 1901 with the eastern pipeline companies of Standard Oil Co. In 1911, at the dissolution of Standard, Bushnell was elected president of the northern group of lines including the Indiana, Northern, Buckeye, and New York transit companies. Bushnell retired as Buckeye president in 1938.

Fredrick M. Neall, 66, retired general sales manager of Atlantic Refining Co.'s foreign markets division, died April 13 in a Camden, Pa., hospital.



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For many years Bendix ignition equipment has given dependable service in a wide variety of petroleum and natural gas applications. The Cooper-Bessemer gas engines, equipped with Bendix* LAR magnetos shown here, provide efficient, economical gas combustion to help move natural gas through the pipeline system at the Short Junction Booster station of Continental Oil Company in Oklahoma.

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LA magnetos now in service can be easily converted to the modern Bendix LAR type with conversion kits now available. They can be obtained from your Bendix ignition distributor or from our factory. For complete details, write SCINTILLA DIVISION OF THE BENDIX CORPORATION, Sidney, New York.

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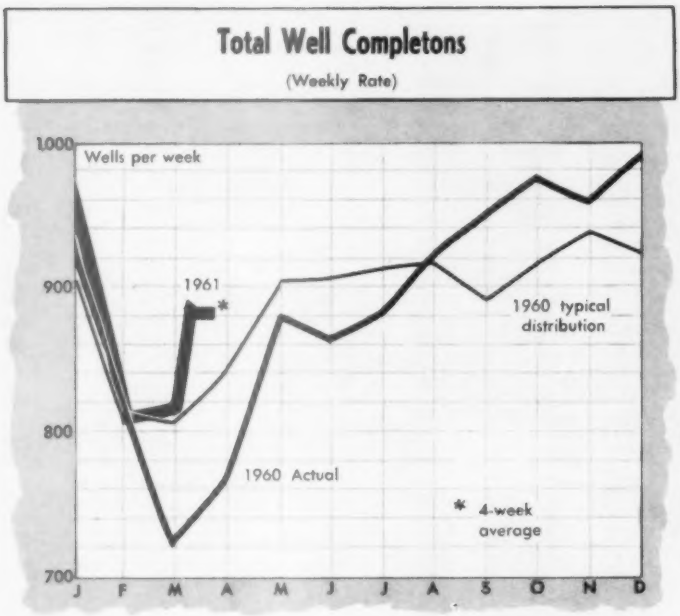
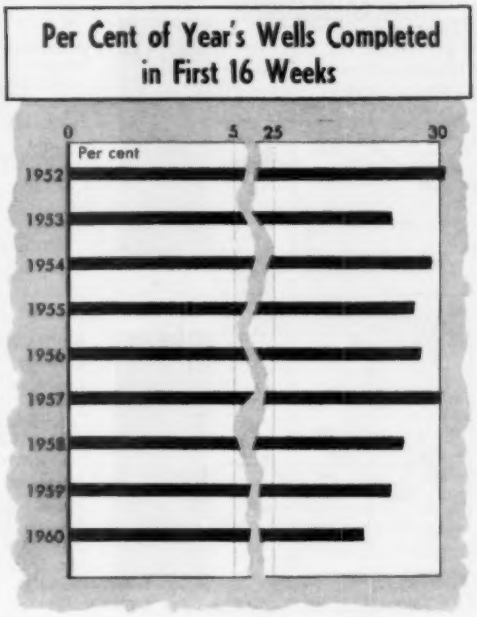




'61 drilling outlook brightens—a little

BY JOHN C. CASPER

OIL OPERATORS completed 13,863 wells through April 22 this year. This total represents an increase of 843 wells over the corresponding weeks of 1960.

Total completions for the period give some indication of drilling programs for the year, but watch those comparisons. Here is one that could lead to a dangerous conclusion.

The period through April 22 represents 30.7% of total days in the year. Drilling had gained 843 wells during this 30.7% of the year. If it continues to gain at this rate for the remainder of the year, total completions for 1961 will show a gain of 2,745 wells over the total recorded for the year 1960.

The fallacy is in that "if" clause. Take a look at the chart on the left. The lines represent average weekly well completions for a 12-month period. Trace the line showing actual completion rates for 1960. The weekly rate for March was down to 723 wells and rose only to 768 wells per week in April. Completion rates for both months were abnormally low.

Take a look at the line that shows a typical monthly distribution of the 46,751 wells drilled in 1960. This seasonal pattern is based on actual completions reported by weeks for years 1955-59.

If 1960 drilling had followed this typical distribution, March completions would have been up to 808 wells per week and April up to 831 per week.

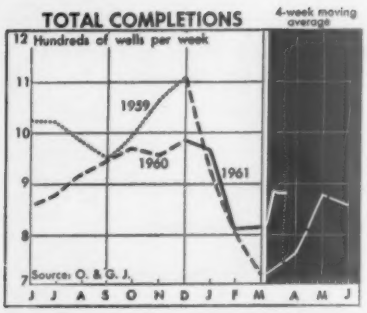
Bars on the right-hand chart represent per cent of each year's drilling reported for the first 16 weeks of the year. The range is from 27.7% to 30.4%, but the ratio of about 27.8 shows up more often than the others.

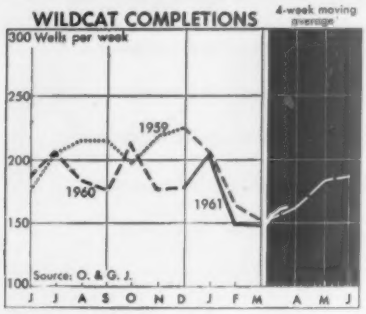
Actual completions for the first 16 weeks this year amounted to 13,863 wells. If these wells represent 28.7% of drilling, the total for the year will be about 48,000 wells for a gain of 4.2% over 1960. This gain rate is about in line with expected increase in producer income from oil and gas.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,268,675	UP	5,375	UP	271,697
Crude stocks	244,704,000	UP	3,569,000	DOWN	14,221,000
Completions	832	UP	32	UP	86
Refinery runs	7,765,000	DOWN	24,000	DOWN	202,000
Gasoline stocks	222,225,000	DOWN	951,000	UP	673,000
Kerosine stocks	26,447,000	DOWN	47,000	UP	7,334,000
Distillate stocks	84,622,000	DOWN	2,012,000	UP	6,214,000
Residual stocks	41,791,000	DOWN	521,000	UP	2,978,000
Four-product stocks	375,085,000	DOWN	3,531,000	UP	17,199,000
Total imports	1,638,600	UP	84,800	DOWN	369,800

Active Rotary Rigs





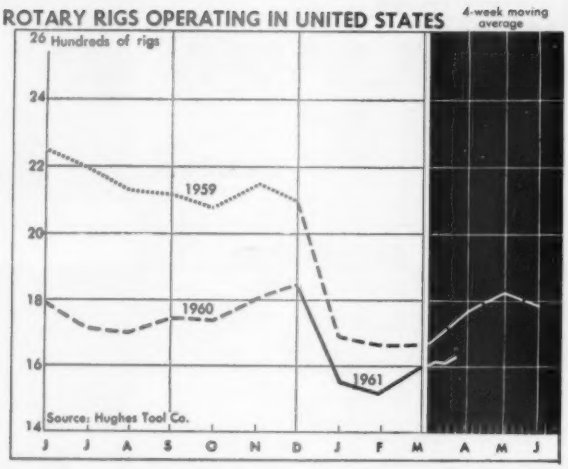
	4-24-61	4-17-61	4-25-60
Alabama	5	5	3
Alaska	9	8	5
Arkansas	13	13	14
Arizona	0	0	2
California	76	77	94
Land	72	74	88
Offshore	4	3	6
Colorado	21	18	30
Florida	0	0	2
Land	0	0	1
Offshore	0	0	1
Georgia	2	0	0
Illinois	26	26	48
Indiana	12	9	6
Kansas	107	103	134
Kentucky	5	4	4
Louisiana	281	251	286
North	40	29	34
S. Inland waters	106	101	118
S. Land	71	67	75
Offshore	64	54	59
Michigan	16	15	13
Mississippi	50	49	73
Missouri	1	1	1
Montana	19	21	17
Nebraska	33	25	19
Nevada	1	0	0
New Mexico	101	102	117
New York	0	0	1
North Dakota	14	14	18
Ohio	7	7	5
Oklahoma	199	185	191
Pennsylvania	12	11	12
Texas	592	601	620
S. Inland waters	5	5	10
S. Land	170	166	153
Offshore	2	3	2
North	57	56	43
Panhandle	49	50	55
East	58	61	62
West Central	150	158	187
West	101	102	108
Utah	24	25	25
Washington	1	2	0
West Virginia	5	4	4
Wyoming	59	62	52
Total U. S.	1,691	1,638	1,796
Cum. avg. to date	1,577	1,569	1,703
Western Canada	87	83	91
Eastern Canada	0	0	2
Grand total	1,778	1,721	1,889

Hughes Tool Co. report.

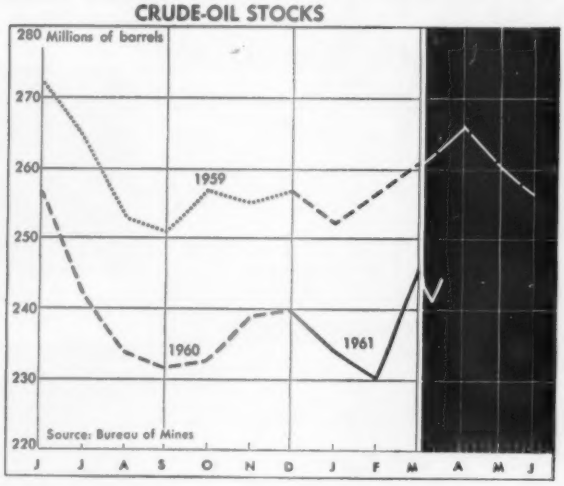
WEEKLY WELL COMPLETIONS . . . WEEK ENDED APRIL 22, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Arkansas	6	2	0	0	4	0	20,495	162	187	1	0	0	0	1	32	48
California	30	21	0	4	5	0	102,980	529	400	6	0	0	1	5	82	88
Colorado	10	1	0	3	6	0	53,567	202	217	5	0	0	0	5	103	103
Illinois	26	7	0	1	18	0	45,179	519	596	10	0	0	0	10	109	155
Indiana	7	1	0	0	6	0	11,505	175	269	4	0	0	0	4	43	115
Kansas	65	27	0	8	29	1	222,857	1,599	948	22	2	0	1	19	322	318
Kentucky	47	8	0	6	33	0	61,921	507	530	4	0	0	0	4	56	63
Louisiana	47	19	0	10	18	0	361,673	1,106	1,003	7	0	0	3	4	162	156
North	17	9	0	3	5	0	54,467	360	322	1	0	0	0	1	59	65
South	22	8	0	4	10	0	226,455	566	510	3	0	0	0	3	90	80
Offshore	8	2	0	3	3	0	80,751	180	171	3	0	0	3	0	13	11
Michigan	14	1	0	1	12	0	41,981	206	219	6	0	0	0	6	84	70
Mississippi	6	3	2	1	0	0	63,471	160	252	0	0	0	0	0	53	82
Montana	4	2	0	0	2	0	28,829	120	76	1	0	0	0	1	52	37
Nebraska	23	12	0	0	11	0	101,142	270	239	12	2	0	0	10	113	92
New Mexico	41	24	0	3	14	0	192,691	534	569	10	0	0	0	10	100	82
West	21	10	0	2	9	0	72,320	209	192	9	0	0	0	9	33	19
East	20	14	0	1	5	0	120,371	325	377	1	0	0	0	1	67	63
New York	0	0	0	0	0	0	0	183	100	0	0	0	0	0	7	7
North Dakota	7	2	0	0	5	0	28,118	72	97	3	0	0	0	3	19	17
Ohio	23	7	0	2	5	9	50,673	327	342	0	0	0	0	0	13	15
Oklahoma	144	54	1	12	50	27	479,353	1,850	1,149	25	3	1	2	19	201	212
Pennsylvania	0	0	0	0	0	0	0	196	185	0	0	0	0	0	10	7
Texas	309	157	13	15	121	3	1,358,567	4,338	4,966	63	5	1	0	57	910	1,014
District 1	21	10	1	0	10	0	54,494	264	352	6	0	0	0	6	92	125
District 2	16	4	4	0	8	0	112,758	211	211	5	0	0	0	5	44	50
District 3	18	7	2	2	7	0	141,985	322	379	3	0	0	0	3	54	73
District 4	14	7	1	2	4	0	94,069	359	372	2	0	0	0	2	76	106
East	23	14	0	0	9	0	120,477	347	378	6	1	0	0	5	77	75
District 7-B	51	22	2	2	25	0	124,319	615	781	10	0	0	0	10	181	212
West	79	52	0	0	27	0	425,799	1,095	1,324	20	3	0	0	17	250	216
District 9	59	32	2	0	22	3	138,594	716	919	7	0	0	0	7	92	132
District 10	28	9	1	9	9	0	146,072	409	313	4	1	1	0	2	34	25
Utah	9	4	0	1	4	0	60,771	89	91	4	0	0	1	3	36	30
West Virginia	0	0	0	0	0	0	0	289	234	0	0	0	0	0	2	2
Wyoming	14	8	0	0	6	0	87,079	311	290	3	0	0	0	3	117	119
Miscellaneous	0	0	0	0	0	0	0	119	61	0	0	0	0	0	86	34
Total U. S.	832	360	16	67	349	40	3,372,852	13,863	13,020	186	12	2	8	164	2,712	2,866
Total prev. week	800	377	18	70	296	39	3,237,149	.....	.....	168	14	1	10	143	.....	.....
Cum. 1961	13,863	6,347	289	1,352	5,002	873	56,412,559	.....	.....	2,712	221	31	131	2,329	.....	.....
Cum. 1960	13,020	6,070	430	1,090	5,061	369	57,404,842	.....	.....	2,866	251	32	92	2,491	.....	.....
Western Canada	33	21	0	6	6	0	240,506	731	742	7	2	0	3	2	234	230

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	4-15-61	4-8-61	4-16-60
Pennsylvania	2,074	2,081	2,114
Other Appalachian	1,239	1,204	1,695
Illinois, Indiana, Michigan	9,039	9,188	9,343
Nebraska and North Dakota	3,073	3,217	2,598
Kansas	9,643	9,653	9,918
Oklahoma	16,120	15,525	17,394
Arkansas	1,971	1,959	2,189
Louisiana	20,215	19,628	18,743
North	3,348	3,164	3,276
South	16,867	16,464	15,467
Mississippi, Alabama, Florida	2,121	2,220	2,372
New Mexico	7,611	7,386	7,725
Texas	104,155	101,899	112,802
East Texas	8,770	8,696	8,596
West Texas	48,085	46,710	50,725
Texas Gulf	17,777	18,195	20,591
Other Texas	29,523	28,298	32,890
Wyoming	17,479	16,845	17,643
Other Rocky Mountain	9,831	9,950	9,856
California	25,426	25,923	28,870
Foreign	†14,707	14,457	15,663
Total	**244,704**	241,135	258,925

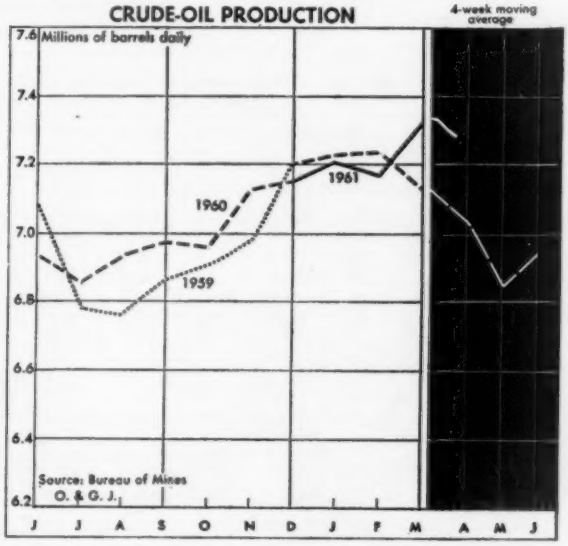
*Bureau of Mines. †Includes 3,984,000 bbl. in California.

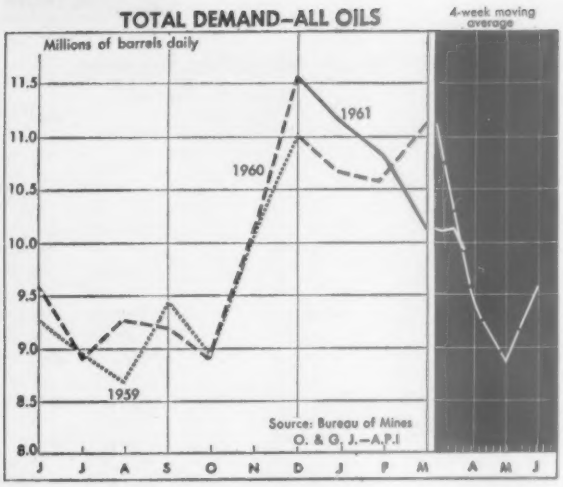
DAILY AVERAGE PRODUCTION FOR WEEK

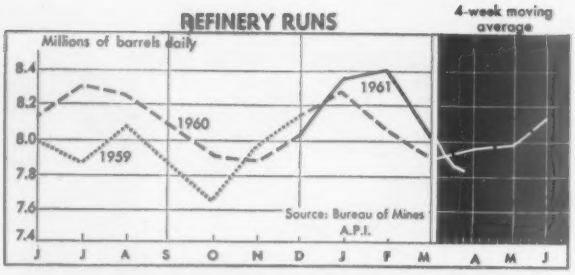
	April 22, 1961			April 15
	Crude oil	Lease condensate	Total	total
Alabama	19,300	.....	19,300	19,250
Alaska	11,000	.....	11,000	11,000
Arkansas	77,500	125	77,625	77,550
California	828,700	.....	828,700	829,000
Colorado	132,300	.....	132,300	132,000
Eastern	39,100	.....	39,100	40,300
Florida	1,100	.....	1,100	1,100
Illinois	216,300	.....	216,300	206,600
Indiana	30,400	.....	30,400	30,600
Kansas	†316,200	.....	†316,200	†315,400
Kentucky	49,300	.....	49,300	49,900
Louisiana	1,004,500	158,400	1,162,900	1,160,250
North	104,500	5,900	110,400	107,750
South	900,000	152,500	1,052,500	1,052,500
Michigan	52,900	.....	52,900	53,200
Mississippi	146,900	4,725	151,625	151,625
Montana	81,100	.....	81,100	80,300
Nebraska	69,200	.....	69,200	68,800
Nevada	450	.....	450	400
New Mexico	304,000	7,400	311,400	311,400
North Dakota	66,400	.....	66,400	68,000
Oklahoma	†546,200	.....	†546,200	†553,250
Texas	2,540,000	94,750	2,634,750	2,634,750
Dist. 1	45,000	2,400	47,400	47,400
Dist. 2	110,000	8,600	118,600	118,600
Dist. 3	312,000	40,000	352,000	352,000
Dist. 4	185,000	14,000	199,000	199,000
Dist. 5	28,000	400	28,400	28,400
Dist. 6	118,000	8,200	126,200	126,200
East Texas field	136,000	.....	136,000	136,000
Dist. 7-B	131,000	400	131,400	131,400
Dist. 7-C	117,000	3,650	120,650	120,650
Dist. 8	1,064,000	11,000	1,075,000	1,075,000
Dist. 9	190,000	3,800	193,800	193,800
Dist. 10	104,000	2,300	106,300	106,300
Utah	84,000	.....	84,000	82,500
Wyoming	385,900	.....	385,900	385,400
Others	‡525	.....	‡525	‡725
Total U. S.	7,003,275	265,400	**7,268,675**	7,263,300
Change from prev. week, up			**5,375**	
Canada	†599,100	.....	†599,100	†581,100
Total U. S. prod., January 1-April 22			811,809,100 bbl.	
Same period last year (crude plus cond.)			*809,990,700 bbl.	

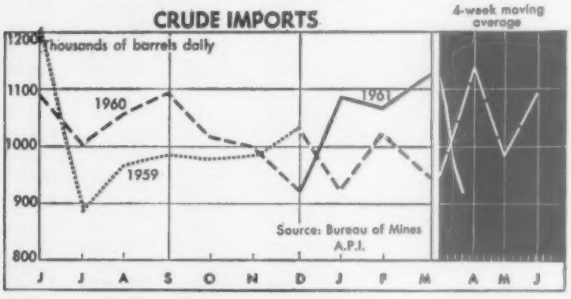
*Includes 26,235,000 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

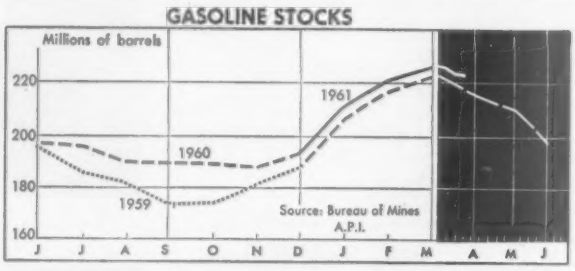
CRUDE-OIL PRODUCTION

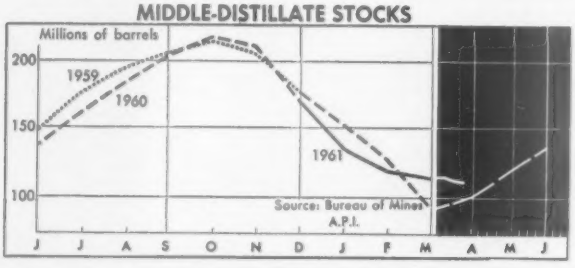


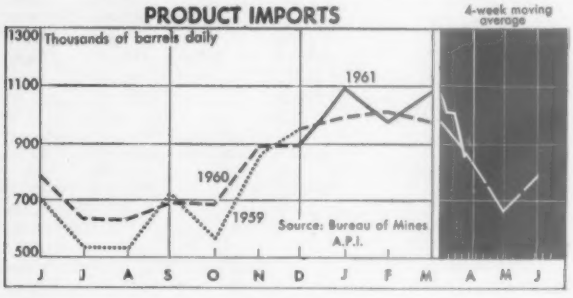


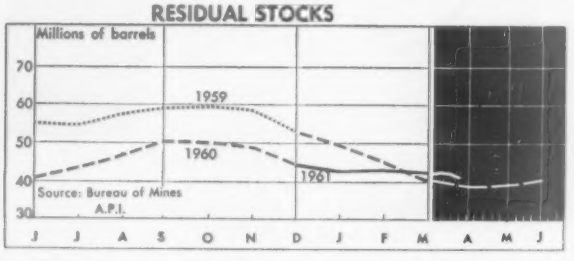












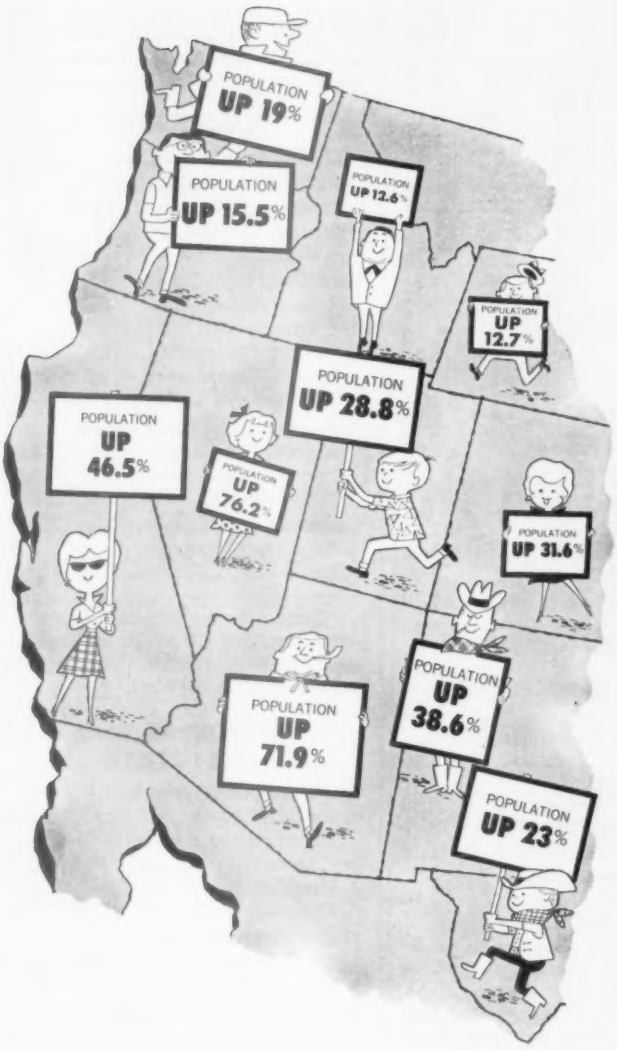
API REFINERY REPORT—APRIL 21, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, April 1960 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,106	475.8	37.1	351.6	131.7	50,017	9,697	23,714	11,092	1,057	510.8	30.1	300.0	146.7
Appalachian:														
Dist. 1	101	41.6	3.3	26.9	7.9	6,349	649	1,786	492	100	41.9	2.9	23.3	12.3
Dist. 2	118	53.9	1.7	19.4	14.6	3,220	384	923	411	90	46.2	4.2	16.6	15.2
Ind., Ill., Ky.	1,297	667.0	84.0	254.6	117.6	41,861	4,328	14,789	5,135	1,480	765.8	77.8	301.0	166.3
Minn., Wis., Dak.	128	61.0	6.9	28.4	18.0	6,869	611	3,768	644	116	56.1	6.4	27.7	14.3
Okla., Kans., Mo.	623	334.1	17.9	127.1	7.1	20,738	1,252	8,556	887	694	350.0	17.4	151.5	14.6
Inland Texas	285	204.9	9.6	43.4	18.7	8,337	527	1,635	2,585	283	212.8	8.2	51.4	120.7
Texas Gulf Coast	1,909	951.0	119.4	406.4	144.0	31,841	3,358	8,599	4,843	1,885	964.0	93.9	439.5	141.2
La. Gulf Coast	622	324.6	52.0	92.3	40.0	10,871	3,078	4,299	1,070	665	366.6	46.9	154.7	48.8
N. La. and Ark.	95	70.7	1.6	23.7	6.9	6,099	598	2,080	109	106	65.2	5.5	21.6	4.7
Rocky Mountain:														
New Mexico	23	11.4	0.4	5.4	1.9	690	49	242	91	23	11.4	0.1	4.3	2.5
Other Rocky Mt.	243	112.9	1.7	56.9	27.1	7,619	339	2,316	953	265	114.4	1.5	60.7	24.1
West Coast	1,214	543.0	37.8	166.3	318.8	27,714	1,577	11,915	13,479	1,196	541.3	29.9	191.0	268.9
Apr. 21, 1961	7,765	3,851.9	373.4	1,602.4	854.3	222,225	26,447	84,622	41,791	7,960	4,046.5	324.8	1,743.3	880.3
Apr. 14, 1961	7,789	3,999.1	351.7	1,641.0	797.3	223,176	26,494	86,634	42,312	.....	.....	.....	.....	.....
Apr. 22, 1960	7,967	4,035.1	300.7	1,811.1	880.6	221,552	19,113	78,408	38,813	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

The West rockets ahead with ***more and more energy*** *from natural gas*



Ten-Year Population Growth Figures from U.S. Census, 1950 and 1960.

Growth and expansion continue to be the two big activities in the West—both for the people who live and work and play in this booming region, and for El Paso Natural Gas Company which supplies natural gas to so many of them for so many purposes.

Much of the story in detail is in the Company's Annual Report for 1960, just out.

The growth part of the story for El Paso, in a sentence:

In 1960, El Paso furnished customers in 11 Western states more than 1¼ trillion cubic feet of gas—an all-time record and over four times as much as was delivered just a decade ago.

The growth story in the 11 states is a climb in population to a total of 35,718,636 (1960 census), up 33.9 per cent in the past 10 years and still rocketing.

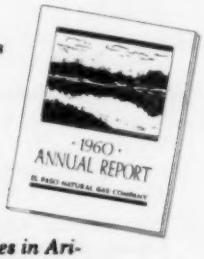
As for expansion—

Demand for El Paso's services and products by long-time customers keeps increasing as families and communities and businesses grow. Then add the millions of new people, more new businesses and all their needs. Add, too, the ever-increasing realization by everyone of the economy and conveniences of gas as a source of dependable energy for a multitude of uses.

And El Paso is expanding to meet this need. To supply its customers—including such growth areas as California—it has developed the most diversified gas supply of any company in the nation. Today, El Paso's pipelines are connected with the principal producing areas of the West and Southwest, in addition to vast reserves in Canada.

The Company's Annual Report reviews a number of important projects recently completed, and reports progress on others from Canada to the Mexican border.

For copies of El Paso's 1960 Annual Report write to: El Paso Natural Gas Company, El Paso, Texas



EL PASO NATURAL GAS COMPANY

El Paso Natural Gas Company provides natural gas to industrial customers and distribution companies in Arizona, California, Colorado, Idaho, Nevada, New Mexico, Oregon, Utah, Washington, West Texas and Wyoming.

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Okla-homa	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Jules-burg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	(†)	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Two buyers announced increase.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.75-4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Buckeye Grade	4.08
Illinois Basin	**3.00-3.05**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34.9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	1.72
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qatar, 41.0°-41.9°, Umm Said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Weyburn (light)	2.06
Midale C	1.70
Venezuela:	
Cumbarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long Ton)

(Latest reported spot fixtures)

★ Gulf-NY, dirty (ATRS—37.5%)	$1.78
★ Carib.-NY, dirty (ATRS—62.5%)	1.03
★ PG-NY, dirty (USMC—80%)	2.54
★ Cal.-Japan, dirty (USMC—72.5%)	1.98
★ PG-UK, dirty (Scale—62.5%) (24s. 2d.)	3.38

★Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	12.25-12.50
Premium (99 octane)	15.00-15.25
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.50-11.00
Regular (92 octane)	10.75-11.25
Premium (98 octane)	11.75-12.25
California (rack) Los Angeles:	
Regular (90 octane)	11.00
Premium (94 octane)	12.00
Premium (100 octane)	13.50
Caribbean area (cargoes):	
Regular (87 octane)	9.50
Premium (97 octane)	11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
Kerosine 42-44	10.375-10.625
Diesel oil (58 d.i. and above)	10.00-10.25
Distillate No. 1	10.00-10.25
Distillate No. 2	9.00-9.25
Gulf Coast (cargoes):	
Kerosine 41-43	9.625-9.875
★ Distillate No. 2	8.5 -9.25
New York Harbor (barges):	
Kerosine 42-43	11.40
Distillate No. 2	10.40
Diesel fuel, 48-52 d.i.	10.55
Caribbean area (cargoes):	
Distillate No. 2	8.625

RESIDUAL FUEL (Bbl.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.90
Gulf Coast (cargoes):	
Bunker C fuel	2.20
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C	2.00
California (rack):	
Bunker C fuel, Los Angeles	2.25

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RATES:
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WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287.

FOR SALE EQUIPMENT

YOU ARE LOSING MONEY . . .
if you have idle or extra oil field equipment not in productive use. You can sell this equipment through the Classified Pages of The Oil and Gas Journal—Why not give us a try next issue?

FRANKS SR. SERVICING UNIT
C/W bed, tool boxes, front and rear pole mountings, large PTO box. $1,750.00. John Cassidy, Jr., 1701 First National Bldg., Tulsa, Oklahoma, LU 5-8368.

WALKER-NEER C-34, Automatic cathead, tools, doghouse, lighplant, float, GMC truck to move equipment. Phone S. H. Lindley, HI 9-2884, Breckenridge, Texas.

1500 FAILING long mast and kelly, gasoline or propane powered with or without Ingersoll-Rand percussion tool. Fred E. Butler, Box 481, Pueblo, Colorado.

FOR SALE
1 —7¼ x 14 Gardner Denver Pump w/Cummins Diesel Engine
1 —D-300 Emsco Power Pump
1 —131' Lee C. Moore Jacknife Derrick & Substructure
6600'—4½" EUE Drill Pipe w/18° taper Flash-welded API Ex Tool Joints
Write for Equipment Inventory.
NOWERY DRILLING COMPANY, INC.
5904 Fairfield Avenue, Shreveport, Louisiana

BARGES
FOR OILFIELD SERVICE

Concrete Deck Barge—
265' x 37' x 11', compartmented Ideal for shallow water storage platform, etc.

Steel Deck Barges—
275' x 52' x 10'
200' x 45' x 9'-6"
Many others

— WIRE — PHONE — WRITE —

JEFFBOAT
JEFFERSONVILLE BOAT AND MACHINE CO.
Box 510 Phone: BUtler 3-3551
Jeffersonville, Indiana

LOCATED HOUSTON, TEXAS
(from Amoco Refinery Co., Destrehan, La.)
HEAT EXCHANGERS
50 to 4,000 sq. ft.
VESSELS—TOWERS
12" to 8' dia.
PETROCHEM FURNACES
½MM, 2½MM, 5MM BTU
PUMPS
50 to 7,000 GPM
—WIRE—PHONE—WRITE—
BRILL EQUIPMENT COMPANY
4101 SAN JACINTO ST., HOUSTON 4, TEXAS
38-68 JABEZ STREET, NEWARK 5, N. J.

FOR SALE EQUIPMENT

2500 FAILING 58' mast, diesel powered, 5 x 8 pump. Sell or rent. Box M-362, The Oil and Gas Journal, Tulsa, Oklahoma.

DOUBLE DRUM spudder on IHC Truck. Cooper E563-42-36. Excellent Condition. Box 736, Great Bend, Kansas—GL 3-8817.

WILSON - GIANT Drawworks—$1,250.00. Good Cond. Stacked near Olney, Ill. Phone Gr. 7-0092 or Write Adv. 500 S. St. James, Evansville 14, Ind.

75 H.P., Reda Pump, 78 stage, complete with 100 H.P. switch box, auto transformer, 2100 ft. armored size I cable. McAdams Pipe & Supply Co., P. O. Box 658, Bristow, Oklahoma—Phone 1711.

CLARK MA-4 Gas Compressor, 150 HP, skid-mounted with radiator and accessories; 2 I.R. XVG6 Gas Compressors; 225 HP Worthington LT6 Compressor; Pumps; Exchangers; Vessels. Brill Equipment Company, 4101 San Jacinto St., Houston 4, Texas.

HIGHLIGHTS

Fixed Bed HYDROFINERS
12,000 BSD Naphtha
5,000 BSD Heating Oil

POWERFORMER
3,000 BSD Fixed Bed

INSTALLED 1955
Will Be Sold As Units or Piecemeal

PETRO-CHEM ISO-FLOW FURNACES with STAINLESS CONE AND TIP

30.7 MM BTU/hr.	CHROME Tubes
19.3 MM BTU/hr.	CHROME Tubes
17 MM BTU/hr.	CHROME Tubes
9.7 MM BTU/hr.	CHROME Tubes
9 MM BTU/hr.	Carbon Tubes
7.5 MM BTU/hr.	CHROME Tubes (2)
5 MM BTU/hr.	Carbon Tubes
2.5 MM BTU/hr.	Carbon Tubes
2 MM BTU/hr.	Carbon Tubes

CENTRIFUGAL BLOWER NEW 1954
7,500 CFM @ 14.4 PSIG SUCTION 42.5 PSIG
Disch. Multi-Stage 8,025 RPM driven by 1,250 HP Synchronous Motor 3/60/2,300/1,200 RPM, 5 KW Direct Conn. Exciter, Falk Speed Increaser 6.70:1 Ratio, Precooler, Intercooler, and Aftercooler.

Send Us Your Requirements

HEAT & POWER CO. INC.
60 East 42nd St., New York 17, N.Y.
310 Thompson Bldg., Tulsa 3, Okla.
Box 5203, Baltimore 24, Maryland

EQUIPMENT WANTED

NEED IMMEDIATEDLY—Gas Compressor. Capacity: 500-700MCF/Day. Inlet Press: 100 Psig. Discharge Press: 900 Psig. Wire—Write Price to: G. A. Smitherman, Bank of the Southwest Bldg., Houston, Texas.

WANTED: Double Cameron or Shaffer Hydraulic Blowout Preventor with closing unit, 17½" Rotary Table, 2½ or 3" Rotary Hose, 125 or 150 Ton Swivel, 5,000' of 4½" Grade E Drill Pipe, 20 Drill Collars, 14 or 16" High Pressure Mud Pump. Give full description, condition, location and price. Box M-370, The Oil and Gas Journal, Tulsa, Oklahoma.

WE ARE SEEKING 2 Born Horizontal or equivalent 2½ million to 5 million, and 5 million to 12 million b.t.u. duty furnaces, with rolled tubes and header boxes. Quote description, age, model, condition, price and location. You may also quote on a vertical unit, although horizontal is preferred. C. Parsley, Mgr., 5830 Carthage Ave. Cincinnati 12, Ohio or phone MElrose 1-6179.

WANTED—COUPLINGS
USED OR NEW SURPLUS
8" pipe size with 8 thread
Quote price and description in detail
COLUMBUS STEEL SUPPLY COMPANY
1000 Bonham Avenue
Columbus 3, Ohio AX 4-4461

WANTED

Used Reda Pump. Must be capable of lifting 12,000 barrels of salt water per day from 1,000 feet and run in 8¾" casing. State HP of motor, size of pump, voltage required, condition and asking price in first response. Also 3 used 1,000 bbl. bolted ungalvanized tanks, one to be cone bottom. Tank to be within 200 mile radius of Tulsa.

HOME-STAKE PRODUCTION COMPANY
Attention: Harold Lawver, 2301 Philtower Bldg.
Tulsa, Oklahoma Phone LU 4-5281

HELP WANTED

MATERIAL AND Production Clerk to age 30 with 3 to 5 years experience, preferably with major company, to be located in Poteau, Oklahoma. Man should be alert, aggressive and generally familiar with oil and gas drilling and production operations. Salary—commensurate with ability. Write Midwest Oil Corporation, 1200 Continental National Bank Building, Fort Worth, Texas, enclosing college transcript, photo and qualifications. All replies will be treated with strictest confidence.

AGGRESSIVE AMBITIOUS Petroleum Engineering graduate, experienced in conditioning wells and taking samples of reservoir fluid. Must qualify as a technical expert with management potential in addition to superior performance in the field. Box M-365, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM Production Engineer, under 25. Rocky Mountain Area. Drilling, producing. Salary about $6,000/year. Needed by small aggressive independent Oil Producing Company. Send resume of experience and qualifications to Box M-369, The Oil and Gas Journal, Tulsa, Oklahoma.

NATURAL GAS Engineer with engineering degree plus 3 to 5 years experince in plant design or operation for work in the Gulf Coast Area. Amerada Petroleum Corp., Gas Department, P. O. Box 2040, Tulsa, Oklahoma.

HELP WANTED

HELP WANTED

ECONOMIC ANALYST

For modern oil refinery located near St. Paul, Minnesota. Work will include preparation of financial reports, forecasts and budgets and the performance of economic analyses and special studies.

A Bachelor of Science degree in chemistry or engineering with M.B.A. degree from an accredited business school. Two or more years experience in petroleum refinery economics or technical service desirable.

Furnish complete resume of experience and education, including salary requirements. Write or apply in person:

GREAT NORTHERN OIL COMPANY

P. O. Box 3596
St. Paul 1, Minnesota
ATTN: C. L. Dretzke

TRANSLATORS—ENGINEERS WANTED. Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N. J.

GEOLOGIST with five to eight years experience, mostly in Southern Louisiana, to open Lafayette District Exploration Office. Address statement of education and experience to: H. W. Bass & Sons, Inc., 1150 Mercantile Dallas Building, Dallas 1, Texas.

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs. $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

GRADUATE ENGINEER with 5—10 years field construction experience of gas transmission lines and who is also familar with office work. Prefer applicant not over 40. Salary open. Send resume to Box M-364, The Oil and Gas Journal, Tulsa, Oklahoma.

Can you . . .

RAISE VENTURE CAPITAL FOR OIL GAS OPERATIONS

We want to hire a man who is already successful in convincing individuals in NYC area in invest venture capital in drilling programs. He will manage our New York office and use his experience, contacts, and knowhow to raise exploration money for us—a Houston-based, successful firm of independent operators. He will get excellent remuneration, interest in wells, and unlimited opportunity to build a future. NYC interviews will be scheduled with applicants who send biographical data, a recent photo, and indication of the risk capital they are now raising. All replies will be kept completely confidential. Box M-356, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

REFINERY EXECUTIVE: Twenty three years responsible and diversified experience in Operations, Economics and Project and Process Engineering, Domestic and Foreign Fields. Engineering and Business degrees. Good References. Box M-354, The Oil and Gas Journal, Tulsa, Oklahoma.

MECHANICAL MAINTENANCE Supervisor available. Age 40. 20 years experience. Engines, Pumps, and all related pump station and refinery equipment. U. S. and foreign. 14 years last position. Fluent Spanish. Box M-366, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, having many years experience with Major companies and consulting. Has own maps, well records and prepared studies of favorable areas ready for exploration in Oklahoma. Post Office Box 1884, Tulsa, Oklahoma.

GEOLOGIST

Excellent training, 10 years experience all facets exploratory activity with most aggressive, successful major company on Gulf Coast. Examined vast amount of data in supervisory position. Respected reputation for successful effort. For required considerations would change to smaller company or responsible group having need of technical or administrative competence. Box M-361, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST, 39, M.S. Ten years experience, exploration, drilling, completion, promotion. Major and independent. Prefer interest deal. Box M-363, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST Central interpretation or field supervision. Master's degree, twenty years experience reflection and drefraction seismograph. Box M-371, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS SERVICE

DELAWARE CORPORATION formed and serviced. American Guaranty & Trust Company. P. O. Box 487, Wilmington, Delaware.

"DO IT YOURSELF" cold process natural gasoline plant. Custom engineered process-mechanical flow diagram, equipment specifications less than $2,500. Free cost and production information. Submit details without obligation to: Box M-359, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

FINANCIAL—Investment Banking Houses and Underwriters reached. Confidential. You can send the details of your proposition direct or thru your attorney to Consultant 817—51st Street, Brooklyn, N. Y.

LEASE AND DRILLING BLOCKS

GEOLOGIC REPORTS indicate large gas deposit on acreage in La Plate County, Colorado. Will take drilling contract and 5% over-ride or sell outright. Write: Box M-372, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR LEASE: 170 acres—5N—6W, section 16 and 17 Grady County. C. H. Minton, 1721 West Main, Oklahoma City, Oklahoma. Telephone CE-20107.

OHIO, WEST VIRGINIA and Kentucky oil and gas leases for sale. Large blocks of acreage in competitive areas. Norman L. Botkin, Box 493, Charleston, West Virginia.

PROVEN LOCATIONS available for drilling in Ohio Clinton Sand Penn Grade Oil Pool with waterflood possibilities. Development staff available. R. Martin, 35 Ellicott place, Staten Island 1, New York. Phone: GIbraltar 7-1845

OHIO AND WEST VIRGINIA acreage for sale close to Big Play. Specialize in 10-15 thousand acre blocks or will lease on your form anywhere in the East. David Law, 716 Union Trust Bldg., Parkersburg, West Virginia. Phone: HU 5-6446.

AVAILABLE—100 acres adjoining production in Hardin County. For information write P. O. Box 836 or Telephone GR 8-3434, Austin, Texas.

Will sell a few "several thousand acre checkerboards" of leases in various areas in Pennsylvania and Ohio where seller will promptly test Oriskany, Helderberg, Medina and deeper formations—no pro-ration—ready market @ 17 cents per M.C.F. Seller willing to participate in drilling deals with responsible buyers. Excellent success record of seller includes recent significant Oriskany gas pool discovery in Ashtabula County, Ohio and "Shearer Oil Pool" discovery in Coshocton County, Ohio in 1952. Write to:

James I. Shearer, President, James Drilling Corporation 250 Newport Road, Blairsville, Pennsylvania

REAL ESTATE

WYOMING MOUNTAIN Ranch fully equipped, ideal for family and friends, or to entertain clients. Superb location, riding, front fishing, big game hunting. Box M-373, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCING

EXPERIENCED PRODUCER, want associates to drill 500 ft. Bartlesville sand, offset to nice producer. Montogomery County, Kansas. Will furnish references. Box M -320, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION FOR SALE

GAS WELL—Holmes County, Ohio. Approx. $200.00 per month income. Will sell for equipment value. Write Adv. 500 S. St. James, Evansville 14, Indiana.

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- ☐ We need personnel
- ☐ I want a new job
- ☐ We buy, sell leases or royalties
- ☐ Other (describe) _____

Mail this coupon to . . .

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Box 1260
TULSA, OKLAHOMA

LEGAL NOTICE

SALE OF OIL AND GAS MINING LEASES. Department of the Interior, Bureau of Indian Affairs, Jicarilla Indian Agency, Dulce, New Mexico. Sealed bids will be received until 3:00 P.M., Mountain Standard Time, May 24, 1961, and then opened at that time in the office of the Jicarilla Indian Agency, Dulce, New Mexico, for the leasing of 11,150 acres of Tribal Indian Land located in Rio Arriba County, New Mexico, within the Jicarilla Indian Reservation for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent of the Jicarilla Indian Agency, Dulce, New Mexico.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Santa Fe, New Mexico. Notice is hereby given that approximately 4,842.13 acres of land in thirty-one parcels within the known geologic structure of certain fields in Eddy, Lea, Rio Arriba, and San Juan Counties, New Mexico, will be offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 2:15 p.m., MST, May 16, 1961, when bids will be opened. Details of the lease offering, how and where to submit bids, may be obtained from the Bureau's Land Office at Santa Fe, New Mexico. Douglas E. Henriques, Manager.

More Discovery Wells

(Continued from page 188)

ILLINOIS

White County:

Shulman Brothers 1 Stoke Heirs, SE NW SE 24-4s-8e. IP 30 BOPD, 225 BWPD, Aux Vases 3,325-76 ft. TD 3,537 ft. Open North Trumbull field.

INDIANA

Newton County:

Niagara Oil Co. 1 Fred Windelburg, NW NE NE 2-31n-8w. IP 1 M.M.c.f.d., Devonian 652-65, 705-15 ft.; Trenton 895-901 ft. TD 910 ft. Opens East Thayer field.

Steuben County:

H. Dickerhoff et al. 1 G. Boyer, SW SE NW 22-36n-12e. IPF 240 M.c.f.d., Devonian 691-722 ft. TD 722 ft. Opens Salem Center field.

SOUTH TEXAS

Live Oak County:

F. A. Johnson 1 F. A. Johnson, 6 miles southeast of Dinero in Shwartz field, John McMullen Sur., A-30. IPF 2,300 M.c.f.d., SICO 2,651 psi., BHPSI 269 psi., dry gas, 750-ft. Goliad-Oakville series 754-59 ft. TD 773 ft. New gas discovery.

Wharton County:

South Taiton field. Western Oil Corp. 1 Ilse Miller, 10 miles west of Wharton in William Robertson Sur., A-55. IPF 4,500 M.c.f.d., SITP 3,420 psi., BHSIP 4,369 psi., GLR 16,000:1, 50°, Cook Mountain 7,732-37 ft.; IPF 3 M.M.c.f.d., SICP 2,450 psi., BHSIP 3,810 psi., GLR 27,000:1, 49.9°, 7,612-22 ft. TD 7,790 ft. New dual gas-condensate discovery.

TEXAS GULF COAST

Brazoria County:

Ada Oil Co. 1 R. D. McDonald, Benjamin C. Franklin Sur., A-192, 3½ miles northeast of Sweeny. IP 1,771 M.c.f.d., 78.5 BOPD, ⅛-in., TP 1,501 psi., perf. 10,280-10,309 ft. TD 11,733 ft. New-field discovery (Ada-Mac).

Chambers County:

Texas National Petroleum Co. 1 Roy Dawson, J. T. White Sur., A-415, 13 miles southeast of Anahuac. AOF 10 M.M.c.f.d., GLR 16,220 cu. ft. per bbl., 58.7°, shut-in TP 2,961 psi., perf. 9,433-38 ft. TD 9,718 ft. Discovery well of Lake Stephenson field—1¾ miles southeast of East Mays field.

DeWitt County:

DeLange, Neathery Schimmel 1 Jessie M. Houchine, M. Fox Sur., A-191, 3 miles southeast of Yorktown. AOF 3,700 M.c.f.d., GLR 42 M.c.f. per bbl., 58°, shut-in BHP 3,112 psi., perf 7,231-43 ft. Wilcox. TD 7,689 ft. New Wilcox reservoir ½ miles west of Monsanto 1 Feller discovery.

Commonwealth Oil Co. 1 Edward Boldt, Gonsalvo Woods Sur., A-482, 5 miles east of Yorktown. AOF 1,220 M.c.f.d., GLR 21,160 cu. ft. per bbl., 68.2°, shut-in TP 2,232 psi., perf. 7,042-52 ft. TD 10,710 ft. New pay in Yorktown field.

Goliad County:

Ralph E. Fair, Inc., 1 Alfred Friar et al., D Canton Sur., A-86, 8 miles north of Goliad. AOF 7,750 M.c.f.d., GOR 45.5 M.c.f. per bbl., 41.5°, shut-in TP 3,658 psi., perf. 9,397-9,400 ft. and 9,403-10 ft., Wilcox. TD 9,536 ft. New-field discovery.

Matagorda County:

Cosen Petroleum Corp. 1 W. D. Cornelius, Jr., Thomas Cayce League, A-14, 1½ miles northeast of Markham. Shut-in gas-condensate well, no gage, perf. 12,300-53 ft., lower Frio. TD 12,354 ft. Discovery well of Cornelius field.

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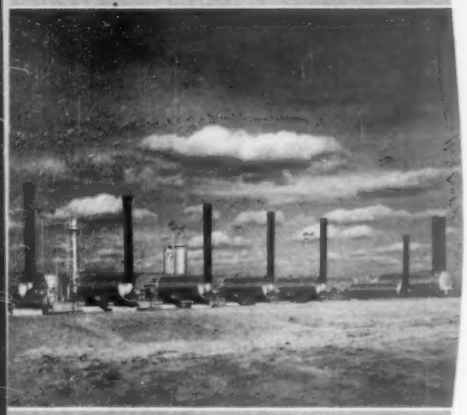

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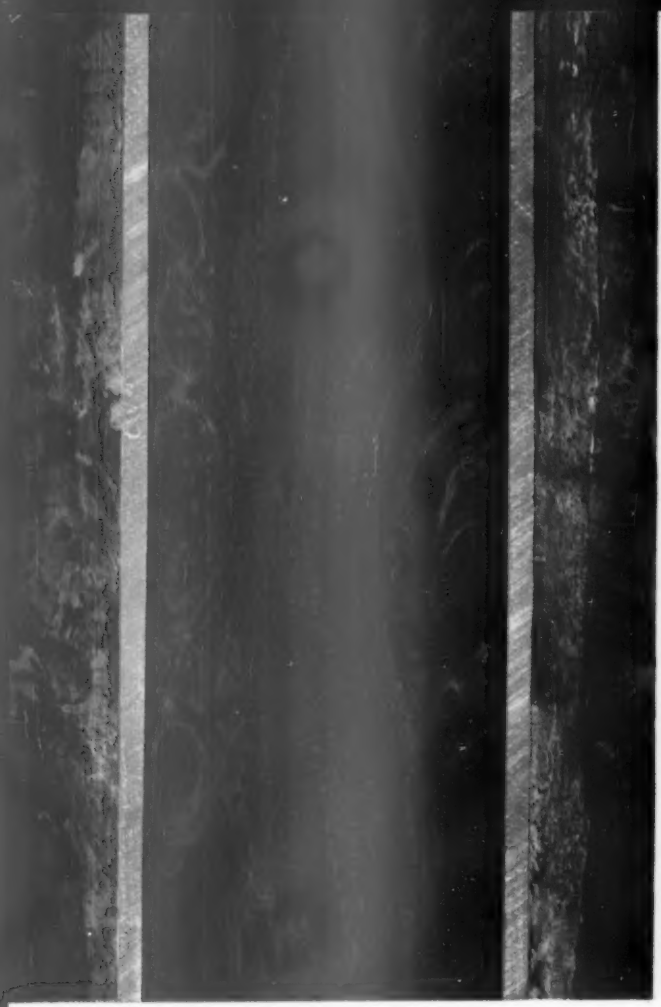

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